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NOVEMBER 25, 1934

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SUPPLEMENT

AMERICAN SOCIETY OF ZOÖLOGISTS

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President.....	A. H. STURTEVANT
Vice-President.....	H. W. RAND
Secretary.....	H. B. GOODRICH
Treasurer	B. H. WILLIER

Executive Committee

(In addition to the four officers)

C. B. DAVENPORT.....	to serve until December, 1934
H. V. NEAL.....	to serve until December, 1935
FERNANDUS PAYNE.....	to serve until December, 1936
W. C. CURTIS.....	to serve until December, 1937
CHARLES ZELENY.....	to serve until December, 1938

*Representative of the Society in the Division of Biology and Agriculture of the
National Research Council*

To serve until July 1, 1935.....	J. H. BODINE
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*Representatives of the Society on the Council of the American Association for the
Advancement of Science*

H. W. LONGLEY	J. W. BUCHANAN
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*Representatives of the Society on the Council of the Union of American
Biological Societies*

A. B. DAWSON	ULRIC DAHLGREN
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*Representatives of the Society on the Advisory Editorial Board of
"Biological Abstracts"*

H. S. PRATT AND G. K. NOBLE.....	Tazonomy
D. H. TENNENT.....	General Embryology
M. H. JACOBS.....	General Physiology

*Representative on the Executive Committee of the Commission for the
Standardization of Biological Stains*

S. I. KORNHAUSER

Managing Editor of the Journal of Morphology

To serve until December, 1936.....	C. E. McCLUNG
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Members of Editorial Board of the Journal of Morphology

To serve until December, 1934

D. E. MINNICH	B. H. WILLIER	L. L. WOODRUFF
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To serve until December, 1935

L. R. CLEVELAND	F. L. HISAW	FRANZ SCHRADER
-----------------	-------------	----------------

To serve until December, 1936

CHARLES ZELENY	J. F. DANIEL	J. S. NICHOLAS
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AMERICAN SOCIETY OF ZOÖLOGISTS

CONSTITUTION

ARTICLE I

NAME AND OBJECT

Section 1. The Society shall be called the "American Society of Zoölogists."

Sec. 2. The object of the Society shall be the association of workers in the field of zoölogy for the presentation and discussion of new or important facts and problems in that science and for the adoption of such measures as shall tend to the advancement of zoölogical science.

ARTICLE II

MEMBERSHIP

Section 1. The membership of the Society shall consist of two classes:

a. Associate membership open to all actively engaged in the field of zoölogy who have had training in zoölogy equivalent to that required for the doctorate degree.

b. Active membership open to those who hold the doctor's degree in zoölogy or who have done work equivalent thereto, and who, in addition to the usual requirements for this degree, have published the results of substantial zoölogical research.

Sec. 2. Election to membership in the Society shall be upon recommendation of the Executive Committee.

Sec. 3. Associate members shall not hold office or vote, but may present papers before the Society without introduction. Associate members shall receive all literature issued by the Society, including the proceedings of the Society, and shall have the same privileges as active members in journal subscriptions.

Sec. 4. Associate members may be elected to active membership in the usual way when the research requirements of active membership have been met.

ARTICLE III

OFFICERS

Section 1. The officers of the Society shall be a President, a Vice-President, a Secretary, a Treasurer, and the members at large of the Executive Committee.

Sec. 2. The Executive Committee shall consist of the President, the Vice-President, the Secretary, the Treasurer, and five members elected from the Society at large. Of these five members, one shall be elected each year to serve five years. If any member at large shall be elected to any other office, a member at large shall be elected at once to serve the remainder of his term.

Sec. 3. These officers shall be elected by ballot at the annual meeting of the Society and their official terms shall commence with the close of the annual meeting, except that the Secretary and the Treasurer shall be elected triennially and shall serve for three years.

Sec. 4. The officers named in Section 1 shall discharge the duties usually assigned to their respective offices. (See by-laws.)

Sec. 5. Vacancies in the board of officers, occurring from any cause, may be filled by election by ballot at any meeting of the Society. A vacancy in either the Secretaryship or the Treasurership occurring in the interval of the meetings of the Society may be filled, until the next annual meeting, by appointment by the Executive Committee.

Sec. 6. At the annual meeting the President shall name a nominating committee consisting of three active members. It shall be the duty of this committee to nominate officers of the Society, including the permanent representatives which the Society is asked to name to various boards and councils. This committee shall make its nominations to the Secretary at least four months before the next annual meeting. Additional nominations for any office may be made in writing to the Secretary by any five members at any time previous to balloting.

ARTICLE IV

MEETINGS OF THE SOCIETY

Section 1. Unless previously determined by the Society, the time and place of the annual meeting shall be determined by the Executive Committee. Special meetings may be called and arranged for by the Executive Committee. Notices of such meetings shall be mailed to all members of the Society at least two weeks before the date set for the meeting.

Sec. 2. Sections of the Society may be organized in any locality by not less than ten members, for the purpose of holding meetings for the presentation of scientific papers. Such sections shall have the right to elect their own officers and also associate members; provided, however, that associate membership in any section shall not confer membership in the Society.

ARTICLE V

QUORUM

Twenty-five members shall constitute a quorum of the Society and four a quorum of the Executive Committee.

ARTICLE VI

CHANGES IN THE CONSTITUTION

Amendments to this Constitution may be adopted at any meeting of the Society upon approval of two-thirds of the members voting, subject to the following conditions:

a. The proposed amendment must be in writing and signed by at least five members of the Society.

b. This signed proposal must be in the hands of the Secretary at least one month before the meeting of the Society at which it is to be considered.

c. The Secretary shall mail copies of the proposed amendment to the members of the Society at least two weeks before the meeting.

d. Members unable to attend may submit their votes in writing to the Secretary.

BY-LAWS

ARTICLE I

DUES

Section 1. The annual dues for active and associate members, unless remitted or changed by the vote of the Society, shall be two dollars.

Sec. 2. Any member in arrears of dues for two years should be dropped by the Executive Committee. Upon payment of arrearage he shall be reinstated.

ARTICLE II

PRESIDENT

Section 1. The President shall preside at scientific sessions and at the business meetings.

Sec. 2. He shall also appoint the committees prescribed by the constitution and by-laws.

ARTICLE III

VICE-PRESIDENT

Section 1. The Vice-President shall preside at sessions designated by the President.

Sec. 2. He shall also assume the duties of the President in the latter's absence.

ARTICLE IV

SECRETARY

Section 1. The Secretary shall keep the records of the Society.

Sec. 2. He shall be responsible for all arrangements for the meetings, including the appointment of local committees.

Sec. 3. Whenever the proper officers of a number of related societies shall have a conference covering matters of mutual interest to the several societies, he shall act as the delegate or representative of this Society.

Sec. 4. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society, and

Sec. 5. He shall be reimbursed out of the funds of the Society for expenses incurred in attending meetings of the Society.

ARTICLE V

TREASURER

Section 1. The Treasurer shall be in charge of the funds of the Society.

Sec. 2. At the annual business meeting of the Society he shall present a statement to date of the funds of the Society.

Sec. 3. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society.

ARTICLE VI

AUDITING COMMITTEE

The President shall annually appoint an auditing committee of two, who shall audit and report upon the financial record and statement of the Treasurer at the meeting for which they were appointed.

ARTICLE VII

PROGRAM RULES

In matters relating to programs for annual meetings, the following rules shall be observed:

Section 1. Titles and abstracts of papers to be presented by any method at the annual meeting must be sent to the Secretary in duplicate before the final date set by him. The length, form, and arrangement of the abstracts must comply with the requests of the Secretary in order to insure prompt publication by The Wistar Institute. The titles and abstracts of papers which do not conform to such requests or papers which are received late may be presented by title only.

Sec. 2. Titles shall be listed in groups according to subject matter, the groups to be determined by the Secretary.

Sec. 3. Whenever conditions require, the Secretary shall schedule two or more groups for the same hour and arrange the program to bring together papers on subjects of more general interest for meetings of the whole Society.

Sec. 4. Each member may have not more than fifteen minutes of the time of the Society at the annual meeting. This time may be used by him to present one or more papers personally or to introduce papers of non-members.

Sec. 5. All papers not read when called for as listed shall be placed at the end of the group list, and if not read when called for the second time, shall be read by title only.

Sec. 6. The titles of 'introduced' papers may be listed in the groups after the titles of papers to be read by members.

LIST OF FORMER OFFICERS

AMERICAN MORPHOLOGICAL SOCIETY

<i>President</i>	<i>Vice-President</i>	<i>Secretary-Treasurer</i>
1890—E. B. Wilson		J. P. McMurrich
1891—C. O. Whitman	E. L. Mark	J. P. McMurrich
1892—C. O. Whitman	H. F. Osborn	J. P. McMurrich
1893—C. O. Whitman	E. B. Wilson	J. P. McMurrich
1894—C. O. Whitman	W. B. Scott	G. H. Parker
1895—E. B. Wilson	W. B. Scott	G. H. Parker
1896—E. L. Mark	H. F. Osborn	G. H. Parker
1897—C. S. Minot	S. I. Smith	G. H. Parker
1898—H. F. Osborn	T. H. Morgan	G. H. Parker
1899—E. G. Conklin	W. M. Wheeler	Bashford Dean
1900—T. H. Morgan	H. C. Bumpus	J. S. Kingsley
1901—J. S. Kingsley	E. A. Andrews	T. H. Montgomery
1902—H. C. Bumpus	G. H. Parker	M. M. Metcalf

Additional Members of the Executive Committee

1891—E. B. Wilson	1897—J. S. Kingsley
H. F. Osborn	Bashford Dean
1892—E. L. Mark	1898—C. B. Davenport
T. H. Morgan	F. R. Lillie
1893—T. H. Morgan	1899—J. P. McMurrich
C. B. Davenport	G. H. Parker
1894—E. A. Andrews	1900—F. R. Lillie
F. H. Herriek	Jacob Reighard
1895—T. H. Morgan	1901—C. F. W. McClure
S. Watase	C. W. Hargitt
1896—E. G. Conklin	1902—H. S. Jennings
William Patten	R. G. Harrison

AMERICAN SOCIETY OF ZOÖLOGISTS

<i>EASTERN BRANCH</i>	<i>President</i>	<i>CENTRAL BRANCH</i>
G. H. Parker	1903	Jacob Reighard
E. A. Andrews	1904	C. H. Eigenmann
W. E. Castle	1905	F. R. Lillie
W. E. Castle	1906	C. C. Nutting
C. B. Davenport	1907	S. A. Forbes
W. M. Wheeler	1908	E. A. Birge
H. S. Jennings	1909	E. A. Birge
T. H. Montgomery	1910	C. E. McClung
H. V. Wilson	1911	George Lefevre
A. G. Mayer	1912	H. B. Ward
Raymond Pearl	1913	H. B. Ward

LIST OF FORMER OFFICERS

EASTERN BRANCH	<i>Vice-President</i>	CENTRAL BRANCH
Jacob Reighard	1903	H. F. Nachtrieb
W. E. Castle	1904	S. J. Holmes
William Patten	1905	William A. Locy
William Patten	1906	George Lefevre
F. H. Herrick	1907	H. B. Ward
H. S. Jennings	1908	M. F. Guyer
H. V. Wilson	1909	M. F. Guyer
H. H. Wilder	1910	H. F. Nachtrieb
H. E. Crampton	1911	R. H. Walcott
G. A. Drew	1912	C. M. Child
Alex. Petrunkevitch	1913	C. M. Child

Secretary-Treasurer

G. A. Drew	1903	Frank Smith
G. A. Drew	1904	F. R. Lillie
H. S. Pratt	1905	C. E. McClung
H. S. Pratt	1906	T. G. Lee
C. J. Herrick	1907	T. G. Lee
L. L. Woodruff	1908	T. G. Lee
L. L. Woodruff	1909	Charles Zeleny
H. W. Rand	1910	H. V. Neal
Raymond Pearl	1911	H. V. Neal
J. H. Gerould	1912	W. C. Curtis
Caswell Grave	1913	W. C. Curtis

Executive Committeemen

F. R. Lillie	Herbert Osborn
T. H. Montgomery	C. H. Eigenmann
H. C. Bumpus	J. G. Needham
H. S. Jennings	S. J. Holmes
E. A. Andrews	W. A. Locy
W. R. Coe	C. M. Child
G. A. Drew	R. H. Walcott
M. M. Metcalf	W. C. Curtis
D. H. Tennent	Oscar Riddle
R. G. Harrison	H. B. Ward
H. E. Jordan	Chauncey Juday
C. E. McClung	H. W. Norris
George Lefevre	C. E. McClung
T. G. Lee	H. F. Nachtrieb

AMERICAN SOCIETY OF ZOÖLOGISTS (AMALAGATED)

<i>President</i>	<i>Vice-President</i>	<i>Executive Committeemen</i>
1914. C. E. McClung	M. F. Guyer	H. E. Jordan—1 year
1915. W. A. Locy	W. E. Ritter	H. F. Nachtrieb—2 years
1916. D. H. Tennent	Charles Zeleny	H. V. Wilson—3 years
1917. M. M. Metcalf	Charles Zeleny	George Lefevre—4 years
1918. George Lefevre	L. L. Woodruff	A. F. Shull—5 years
1919. C. M. Child	H. H. Wilder	D. H. Tennent—5 years
1920. Gilman A. Drew	Caswell Grave	R. P. Bigelow—5 years
1921. Charles A. Kofoid	Aaron T. Treadwell	L. J. Cole—4 years
1922. H. H. Wilder	Bennet M. Allen	H. V. Wilson—5 years
1923. M. F. Guyer	Robert A. Budington	M. M. Metcalf—5 years
1924. R. G. Harrison	R. K. Nabours	George Lefevre—5 years
1925. C. R. Stockard	C. R. Moore	C. M. Child—5 years
1926. S. O. Mast	W. C. Allee	G. A. Drew—5 years
1927. S. J. Holmes	Robert Chambers, Jr.	C. A. Kofoid—5 years
1928. Caswell Grave	M. H. Jacobs	H. H. Wilder—5 years
1929. C. B. Davenport	Fernandus Payne	J. H. Gerould—1 year
1930. H. V. Neal	E. E. Just	M. F. Guyer—5 years
1931. Fernandus Payne	D. E. Minnich	R. G. Harrison—5 years
1932. W. C. Curtis	L. V. Heilbrunn	C. R. Stockard—5 years
1933. Charles Zeleny	J. H. Bodine	S. O. Mast—5 years
		S. J. Holmes—5 years
		Caswell Grave—5 years

Secretary-Treasurer

1914–1918. Caswell Grave	1918–1921. W. C. Allee
<i>Secretary</i>	<i>Treasurer</i>
1921–1924. W. C. Allee	1922. D. H. Tennent
1925–1928. D. E. Minnich	1923–1924. R. H. Bowen
1928–1929. L. B. Arey	1925–1930. L. B. Arey
1929–1930. D. E. Minnich	1930–1933. A. B. Dawson
1930–1933. W. H. Cole	

*Representative in the Division of Biology and Agriculture,
National Research Council*

M. F. Guyer 1919–1921	G. H. Parker 1919–1922	F. R. Lillie 1919–1923
William Patten 1921–1924	H. S. Jennings 1922–1925	E. G. Conklin 1923–1926
J. T. Patterson 1924–1927	L. L. Woodruff 1925–1928	H. S. Jennings 1929–1931
G. H. Parker 1926–1929	E. G. Conklin 1926–1929	L. C. Dunn 1931–1932

Associate Editors of the Journal of Morphology

1921.	Gary N. Calkins	J. S. Kingsley	William Patten
1921-1922.	E. G. Conklin	M. F. Guyer	W. M. Wheeler
1921-1923.	C. A. Kofoed	F. R. Lillie	J. T. Patterson
1922-1924.	G. A. Drew	H. V. Neal	L. L. Woodruff
1923-1925.	Caswell Grave	D. H. Tennent	H. V. Wilson
1924-1926.	Helen Dean King	S. O. Mast	A. A. Schaeffer
1925-1927.	R. W. Hegner	Fernandus Payne	H. B. Ward
1926-1928.	L. J. Cole	J. H. Gerould	M. H. Jacobs
1927-1929.	W. C. Curtis	J. Percy Moore	A. F. Shull
1928-1930.	Edgar Allen	G. A. Baitzell	R. E. Coker
1929-1931.	S. R. Detwiler	R. S. Lillie	H. J. Muller
1930-1932.	W. R. Coe	E. N. Harvey	H. E. Jordan
1931-1933.	L. V. Heilbrunn	S. O. Mast	G. K. Noble

LIST OF PLACES OF MEETING

AMERICAN MORPHOLOGICAL SOCIETY

1890—Boston	1894—Baltimore	1899—New Haven
1891—Philadelphia	1895—Philadelphia	1900—Baltimore
1892—Princeton	1896—Boston	1901—Chicago
1893—New Haven	1897—Ithaca	1902—Washington
	1898—New York	

CENTRAL NATURALISTS

1899—Chicago	1900—Chicago
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SOCIETY OF AMERICAN ZOÖLOGISTS

1901—Chicago	1902—Washington
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AMERICAN SOCIETY OF ZOÖLOGISTS

EASTERN BRANCH	JOINT MEETINGS	CENTRAL BRANCH
1903—Philadelphia	1905—Ann Arbor	1903—St. Louis
1904—Philadelphia	1908—Baltimore	1905—(Mch.) Chicago
1906—New York	1911—Princeton	1907—(Mch.) Madison
1907—New Haven	1912—Cleveland	1907—Chicago
1909—Boston	1913—Philadelphia	1910—(Apr.) Iowa City
1910—Ithaca		1910—Minneapolis
		1912—(Apr.) Urbana

MEETING PLACES

1914—Philadelphia	1921—Toronto	1928—New York
1915—Columbus	1922—Boston	1929—Des Moines
1916—New York	1923—Cincinnati	1930—Cleveland
1917—Minneapolis	1924—Washington	1931—New Orleans
1918—Baltimore	1925—New Haven	1932—Atlantic City
1919—St. Louis	1926—Philadelphia	1933—Boston
1920—Chicago	1927—Nashville	

PROGRAM FOR THE THIRTY-SECOND ANNUAL MEETING OF THE AMERICAN SOCIETY OF ZOÖLOGISTS

UNIVERSITY OF PITTSBURGH, PITTSBURGH, PENNSYLVANIA
DECEMBER 27, 28, 29, 1934

Features of the meeting are the symposium on mitosis held Thursday afternoon, the joint symposium with the American Naturalists on cytogenetic evolutionary processes held on Saturday afternoon, and the introduction of two section meetings on Friday morning dealing with special topics and arranged to allow ample time for discussion. This innovation is instituted in accordance with the recommendation made in the report of the committee on future policies of the Society, presented at the last annual meeting. The papers in one section have been arranged by Dr. Robert Chambers and deal with cellular physiology. The second section is a joint meeting with the American Society of Parasitologists and the program has been arranged by Dr. W. H. Taliaferro on immunological relations of host to parasite.

The current calendar brings about the opening of the session on the second day after the Christmas holiday, entailing conflicts with the opening session of the A.A.A.S. This has made the planning of the schedule more difficult than usual. On this account the biological smoker has been deferred until the second evening. The annual dinner for all zoölogists and friends will be held Friday evening and the address will be given by Dr. George L. Streeter, who will speak on "The Education of an Anatomist."

As in previous years the Society is indebted to The Wistar Institute for making possible the early publication of the program and abstracts. The minutes of the annual meeting and list of officers and members for 1935 are scheduled to appear in the January number of this journal. An alphabetical author index of all persons contributing to this program will be found on pages 103 to 106.

TRANSPORTATION ARRANGEMENTS

Reduced railway rates on the receipt certificate plan have been granted by almost all railroads in the United States and Canada. Persons attending the meeting should purchase a first-class, one way ticket to Pittsburgh, securing a Receipt Certificate reading "For the American Association for the Advancement of Science and Associated Societies." The certificate must be left at the registration desk to be called for later in the same place. Each person presenting an endorsed and validated certificate may purchase a return ticket for one-third of the regular fare, on the same route as used in going to Pittsburgh. Tickets to Pittsburgh from many points may be purchased between December 24th and December 29th, although from far western points they may be purchased as early as December 15th. Return tickets must be purchased by January 5th, 1935.

From certain western points still lower rates may be obtained and in all places it will be desirable to consult the local agent for further possible reductions.

The places of meeting and hotel headquarters are conveniently located. All of the sessions of the Society will be held in the new Cathedral of Learning which is located across Bigelow Boulevard from the Schenley Hotel. This new building of the University of Pittsburgh is not entirely completed but will offer ample facilities for the meetings of the Society. The zoölogists' dinner and biologists' smoker will be held at the University Club at 123 University Place. This is the second building on University Place which is opposite the Fifth Avenue entrance of the Hotel Schenley.

To reach the University of Pittsburgh from the Pennsylvania Railroad Station follow Wood Street to Fifth Avenue (three long blocks) and take any car *but* no. 81 to Hotel Schenley (ten-minute ride). From the Pittsburgh and Lake Erie and the Baltimore and Ohio Stations take any car going *in* town. Get transfer and change at Fifth Avenue and Smithfield Street. At Fifth Avenue taken any car *but* no. 81 to Hotel Schenley. Taxi fare from stations to the University is about \$1.00 for one or more passengers.

PROGRAM

THURSDAY, DECEMBER 27TH.

- 10.00 A.M. *Sect. a.* Physiology. Papers 1 to 10, inclusive. Room 817 Cathedral of Learning.
- Sect. b.* Embryology. Papers 76 to 87, inclusive. Room 828 Cathedral of Learning.
- 2.00 P.M. Symposium on Mitosis. Room 817 Cathedral of Learning.
1. "The morphology of the mitotic spindle."—Franz Schröder, Columbia University.
 2. "Modifications on mitosis in merogony and gynogenesis."—Gerhard Fankhauser, Princeton University.
 3. "Differential behavior of the mitotic figure in the cleaving insect egg."—Alfred F. Huettnner. New York University.
 4. "Factors influencing chromosome movements in mitosis."—Charles W. Metz. Johns Hopkins University and the Carnegie Institution of Washington.

The opening session of the American Association for Advancement of Science will be held on Thursday evening in the Carnegie Music Hall and will be addressed by the Retiring President, Henry Norris Russell of the Princeton Observatory. The address will be followed immediately by a reception tendered by the local committee.

FRIDAY, DECEMBER 28TH

- 9.30 A.M. *Sect. a.* Joint session with the American Society of Parasitologists on the "Immunological relations between host and parasite." Discussion lead by Dr. W. H. Taliaferro. Papers 104 to 109, inclusive. Room 817, Cathedral of Learning. The discussion will be closed at 11.30 and will be followed by the address by Dr. E. E. Tyzzer, President of the American Society of Parasitologists.
- 9.30 A.M. *Sect. b.* Endocrinology. Papers 54 to 63, inclusive. Room 828 Cathedral of Learning.
- 10.00 A.M. *Sect. c.* Cellular Physiology. Discussion lead by Dr. Robert Chambers. Papers 11 to 15, inclusive. Room 813 Cathedral of Learning.
- 12.10 P.M. Business meeting of section F. Room 828 Cathedral of Learning.
- 12.20 P.M. Business meeting of the American Society of Zoologists. Room 828 Cathedral of Learning.
- 2.00 P.M. Demonstrations. Papers 10, 26-32, 64-66, 88-90, 114, 115, 127-130, 148, 149. Room 901 Cathedral of Learning.
(Demonstrations by the Genetic Society of America will be in Room 917 and by the American Society of Parasitologists in Room 988.)

- 6.30 P.M. Zoölogists' Dinner. Address by Vice-President of Section F, Dr. George L. Streeter on "The Education of an Anatomist." University Club, 123 University Place.
- 10.00 P.M. Biologists' Smoker, University Club, 123 University Place.

SATURDAY, DECEMBER 29TH

- 10.00 A.M. *Sect. a.* Physiology. Papers 16-25, inclusive. Room 817 Cathedral of Learning.
- 10.00 A.M. *Sect. b.* Cytology, Histology, Protozoology, Invertebrate Zoölogy and Miscellaneous. Papers 121-126, 135, 136, 146, 147, 161, 162. Room 828 Cathedral of Learning.
- 10.00 A.M. *Sect. c.* Parasitology, Morphology, Ecology. Papers 110-113; 137-140; 154-156. Room 813 Cathedral of Learning.
- 2.00 P.M. Joint session with American Naturalists, Botanists and Geneticists. Symposium on "Cytogenetic Evolutionary Processes and their bearing on Evolution Theory."
1. "Cytogenetic evolutionary processes in plants."—R. A. Brink.
 2. "Role of genes evolution."—M. Demerec.
 3. "Factors of evolution in fossil series."—C. L. Fenton.

The symposium will be held in the Auditorium of the Young Men's Hebrew Association on Bellefield Street.

LIST OF TITLES

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

1. Experimental changes in the protoplasmic consistency of amoeba. Douglas Marsland, New York University. (Introduced by H. A. Charipper.) (Cinema; 12 min.)
2. The function of sulphur in various forms in growth in *Chilomonas paramecium*. S. O. Mast and D. M. Pace, Johns Hopkins University. (15 min.)
3. Growth characteristics as related to initial reproductive capacity in a clone of *Daphnia*. Thelma R. Wood, Lester Ingle and A. M. Banta, Brown University. (Lantern; 15 min.)
4. The action of soft x-rays on Cladocera (*Daphnia magna*). G. Snider and H. Kersten, University of Cincinnati. (Introduced by H. L. Wieman.) (Lantern; 10 min.)
5. The relation of cell size to growth in insect larvae. Wm. Trager, Rockefeller Institute. (Introduced by Norman R. Stoll.) (Lantern; 10 min.)
6. Regional growth rates in insects. Nellie M. Payne, University of Minnesota. (Lantern; 15 min.)
7. Dark adaptation in the eye of the drone fly, *Eristalis tenax*. William L. Dolley, Jr., W. J. Bowen, and C. C. Hassett, University of Buffalo. (Lantern; 15 min.)
8. Mechanism of metamorphosis of ascidian larvae. Caswell Grave, Washington University. (Lantern; 15 min.)
9. Oil-soluble and water-soluble neurohumors. G. H. Parker, Harvard University. (Lantern; 15 min.)
10. Comments on the so-called resonance principle of nervous control. Paul Weiss, University of Chicago. (10 min.) (Also by demonstration.)

(Papers 11 to 15, inclusive, form the program for the special session on cellular physiology.)

11. Some experiments on hemolysis. R. Höber, University of Pennsylvania. (Introduced by Robert Chambers.) (Lantern; 15 min.)
12. Cellular reactions to compression and decompression. Dugald E. S. Brown, New York University and Bellevue Hospital Medical College. (Introduced by H. B. Goodrich.) (Lantern; 15 min.)
13. Permeability of living cells to heavy water. Balduin Lucké and E. Newton Harvey, University of Pennsylvania and Princeton University. (Lantern; 15 min.)
14. Free and bound calcium in stimulation and injury. L. V. Heilbrunn, D. Mazia and H. B. Steinbach, University of Pennsylvania. (Lantern; 15 min.)

15. The mechanism of cytoplasmic fission in *Amoeba proteus*. H. W. Chalkley, U. S. Public Health Service. (Lantern; 15 min.)
16. Parthenogenesis in *Asterias* eggs by means of iodine-containing compounds. Alvalyn E. Woodward, University of Michigan. (Lantern; 15 min.)
17. Electro-measurements of the permeability of the grasshopper egg membrane. Theo. L. Jahn, State University of Iowa. (Lantern; 10 min.)
18. Concerning the effect of numbers present on first cleavages and early development in *Arbacia*. W. C. Allee and Gertrude Evans, Marine Biological Laboratory and The University of Chicago. (Lantern; 15 min.)
19. Chemical hibernation in heavy water of low concentration. T. Cunliffe Barnes and E. J. Larson, Yale University. (Introduced by George A. Baitsell.) (Lantern; 10 min.)
20. Oxygen tension and urine production in frogs. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)
21. The effects of various carbon dioxide tensions on the beating of the lateral walls of the grasshopper embryo, *Melanoplus differentialis*. J. F. Walker, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 8 min.)
22. The respiratory metabolism of *Galleria mellonella* (bee moth) during metamorphosis at different constant temperatures. Frederick Crescitelli, Brown University. (Introduced by H. E. Walter.) (Lantern; 15 min.)
23. Application of the Dale anaphylactic test to study of zoological specificity. Paul A. Moody, University of Vermont. (Introduced by Henry F. Perkins.) (Lantern; 10 min.)
24. The effects of severe and prolonged vitamin E deficiency in the chick. F. B. Adamstone, University of Illinois. (Lantern; 15 min.)
25. The variability of the erythrocyte count in the individual. Thomas B. Magath, Joseph Berkson and Margaret Hurn, Mayo Clinic. (Lantern; 15 min.)

By demonstration

26. Stimulation of the barnacle, *Balanus balanoides*, by NaCl, Na₂SO₄, NaNO₃, glucose and urea. (William H. Cole and James B. Allison, Rutgers University. (Charts.)
27. Correlation between Dinoflagellate population of sea water and behavior of the barnacle, *Balanus balanoides*. James B. Allison and William H. Cole, Rutgers University. (Charts.)
28. Regional growth rates in insects. Nellie M. Payne, University of Minnesota. (See abstract no. 6.)
29. Embryonic anomalies in embryos of *Melanoplus differentialis* following x-irradiation. Titus C. Evans, State University of Iowa. (Introduced by J. H. Bodine.)
30. Application of the Dane anaphylactic test to study of zoological specificity. Paul A. Moody, University of Vermont. (Introduced by Henry F. Perkins.) (See abstract no. 23.)
31. Types of ovarian injury following x-irradiation in guinea pigs. Ida T. Genter, University of Cincinnati.

32. A method of cultivating tissue from granulating wounds in the adult dog. Margaret R. Murray and Clay Ray Murray, College of Physicians and Surgeons.

By title

33. An alternative method for the evaluation of the interfacial tension between oil and protoplasm within living cells. Frederick Seitz and Herbert Shapiro, Princeton University. (Introduced by E. N. Harvey.)
34. An electrometric study of the reducing intensity of luminous bacteria. Irvin M. Korr, Princeton University. (Introduced by E. N. Harvey.)
35. The relation between temperature kind and concentration of salts, hydrogen ion concentration and rate of ingestion in *Amoeba proteus*. R. A. Fennell, Johns Hopkins University. (Introduced by S. O. Mast.)
36. The effect of polarized light on budding rate of hydra. E. H. Behre, Louisiana State University.
37. Analysis of the protective value of biologically conditioned fresh water for the marine turbellarian, *Procerodes*. IV. The effect of calcium. R. B. Oesting and W. C. Allee, Marine Biological Laboratory and The University of Chicago.
38. Histological studies on the marine turbellarian *Procerodes wheatlandi* exposed to biologically conditioned and other similarly hypotonic water. Lilian Henderson Fowler, Marine Biological Laboratory and Louisiana Polytechnic Institute. (Introduced by W. C. Allee.)
39. Further data on induced prolongation of life in *Daphnia longispina*. Lester Ingle, Brown University. (Introduced by A. M. Banta.)
40. To what extent is developmental block dependent upon metabolic activity of embryonic cell. J. H. Bodine, State University of Iowa.
41. Studies on the rhythmic activities of embryos (Orthoptera). Vincent Thompson, State University of Iowa. (Introduced by J. H. Bodine.)
42. Desiccation and survival of the Japanese beetle (*Popillia japonica* Newman). D. Ludwig, New York University.
43. The photomechanics of the mating attraction in the firefly. John B. Buck, Johns Hopkins University. (Introduced by S. O. Mast.)
44. The effect of light on the orientation and stability of young plectognath fishes. C. M. Breder, Jr., New York Aquarium and John E. Harris, University of Cambridge.
45. Sex recognition in the viviparous poeciliid *Lebistes reticulatus*. C. M. Breder, Jr., and C. W. Coates, New York Aquarium.
46. Effects upon young male ferrets (*Putorius vulgaris*) of a constant day length of 8½ hours, and of 6 hours of illumination after dark between November and June. T. Hume Bissonnette, Trinity College and Marine Biological Laboratory.
47. Reversal of the sexual cycle in male ferrets by increasing periods of exposure to light between October 2nd and March 30th. T. Hume Bissonnette, Trinity College and Marine Biological Laboratory.
48. The relation of temperature to respiratory regulation in the leech (*Hirudo medicinalis*). Verlus F. Lindeman, Syracuse University.
49. The respiratory quotient of developing grasshopper embryos (*Melanoplus differentialis*). Edgar John Boell, State University of Iowa. (Introduced by J. H. Bodine.)

50. Methylene blue catalysis of oxidations in the embryonic cells of *Melanoplus differentialis* (Orthoptera). J. H. Bodine and E. J. Boell, State University of Iowa.
51. Studies of the electromotive force of biological systems: IV. The effect of carbon monoxide on the E. M. F. of frog skin. A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)
52. Antagonism of methylene blue and KCN for EMF and respiration of frog's skin. Gordon Marsh, State University of Iowa. (Introduced by J. H. Bodine.)
53. The effect of aggregation on oxygen consumption in snakes. H. J. Clausen, American Museum of Natural History.

ENDOCRINOLOGY

Read

54. Prolactin induces broodiness in fowl. Oscar Riddle, Robert W. Bates and Ernest L. Lahr, Carnegie Institution of Washington. (Lantern; 15 min.)
55. The effects of daily injections of Hebin on the development of sexual characters in female Leghorn chicks. L. V. Domm, The University of Chicago. (Lantern; 15 min.)
56. Effects of thyroxin on plumage of the English sparrow, *Passer domesticus* (Linnaeus). Dorothea Starbuck Miller, State University of Iowa. (Introduced by Emil Witschi.) (Lantern; 5 min.)
57. The oestrous-producing principle in the urine of guinea pigs with x-irradiated ovaries. Ida T. Genther, University of Cincinnati. (Lantern; 15 min.)
58. Factors which govern ovarian development. H. L. Fevold, F. L. Hisaw and R. O. Greep, University of Wisconsin. (Introduced by W. S. Marshall.) (Lantern; 15 min.)
59. The follicular apparatus of the ovary of the immature rat and some of the factors which influence it. C. E. Lane and F. L. Hisaw, University of Wisconsin. (Introduced by George Wagner.) (Lantern; 15 min.)
60. A physiological explanation of the oestrous cycle of the rat. F. L. Hisaw, H. L. Fevold, M. A. Foster and A. A. Hellbaum, University of Wisconsin. (Lantern; 15 min.)
61. Sexual periodicity in the male ground squirrel (*Citellus tridecemlineatus*). L. J. Wells, University of Chicago. (Introduced by Carl R. Moore.) (Lantern; 15 min.) (Also by demonstration.)
62. Effect of thyroidectomy on testicular function. George K. Smelser, Columbia University. (Lantern; 15 min.)
63. The effects of hypophysectomy and thyroidectomy on the shedding process of snakes. Walter H. Schaefer, University of Wisconsin. (Introduced by M. F. Guyer.) (Lantern; 7 min.)

By demonstration

64. Sexual periodicity in the male ground squirrel (*Citellus tridecemlineatus*). L. J. Wells, The University of Chicago. (See abstract no. 61.)
65. The effect of thyroid and thyroxin injections on the testis and accessory reproductive organs of the rat. George K. Smelser, Columbia University. (No abstract received.)

66. The cytological changes in the anterior pituitary of the hypo- and hyper-thyroid rats. Aura E. Severinghaus and George K. Smelser, Columbia University. (No abstract received.)

By title

67. The effect of thyroxin injections upon the feather of the guinea fowl. Mary Hardesty, Tulane University.
68. The effect of postpubertal castration on the plumage and head furnishings in the guinea fowl. Mary Hardesty, Tulane University.
69. Feather germ tissue cultivated in vitro. Mary Hardesty, Tulane University.
70. Behavioristic versus anatomical signs in the identification of oestrus in the guinea pig. William C. Young, Hugh I. Myers and Edward W. Dempsey, Brown University.
71. Hormone production of rat testicular fragments. Ira B. Hansen, Union College.
72. The influence of several endocrines on hair growth in the dorsum of the white rat. Earl O. Butcher, Hamilton College.
73. Brepheoplastic subcutaneous graft of the thyroid in the rat. Raoul M. May, Institut Pasteur.
74. An experimental study of ovarian irradiation and transplantation in the rat. James Mandel, New York University. (Introduced by H. O. Haterius.)
75. Precocious maturity in immature female guinea pigs following treatment with pituitary extracts. Roy O. Greep, University of Wisconsin. (Introduced by Frederick L. Hisaw.)

EMBRYOLOGY

Read

76. Life history studies on some Pacific annelids. John E. Guberlet, University of Washington. (15 min.)
77. Changes in radiosensitivity of grasshopper embryos during development. Titus C. Evans, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 7 min.)
78. The effect of x-rays on differentiation in *Drosophila* eggs. P. S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)
79. Normal development of *Drosophila melanogaster* following removal of pre-blastodermic ooplasm. Benjamin P. Sonnenblick, New York University. (Introduced by R. B. Howland.) (Lantern; opaque projection; 10 min.)
80. The differentiation of the sympathetic nervous components of the chick suprarenal in chorio-allantoic grafts. Alfred Brauer, University of Kentucky. (Lantern; 5 min.)
81. Experiments to determine the presence, location and effects of an organization center in bruchid (Coleoptera) eggs. Alfred Brauer and A. C. Taylor, University of Kentucky. (Lantern; 5 min.)
82. A relationship between size of egg and a lethal malposition of the embryo in the domestic fowl. F. B. Hutt, University of Minnesota and Cornell University. (Lantern; 10 min.)

83. The origin of melanoblasts in early embryonic stages of *Triturus torosus* as studied by the Dopa technique. E. W. Blanchard and H. M. McCurdy, Bryn Mawr College and Biological Laboratory, Cold Spring Harbor. (Introduced by D. H. Tennent.) (Lantern; 10 min.)
84. The source of pigment cells in amphibia. Graham P. DuShane, Yale University and State University of Iowa (Introduced by Ross G. Harrison.) (Lantern; 10 min.)
85. Mutual size regulation between eyeball and lens in *Amblystoma*. W. W. Ballard, Dartmouth College. (Introduced by W. B. Unger.) (Lantern; 10 min.)
86. The metabolic rate of developing amphibia with special reference to sexual differentiation. Irvin A. Willis, State University of Iowa. (Introduced by Emil Witschi.) (Lantern; 10 min.)
87. The larval development of reciprocal species hybrids in *Triton*. V. Hamburger, The University of Chicago. (Lantern; 15 min.)

By demonstration

88. Pituitary activity and the metamorphic pattern in *Anura*. William Etkin, College of the City of New York and American Museum of Natural History. (Introduced by L. H. Hyman.)
89. The ovary of *Basiliscus basiliscus*. Geo. G. Scott, City College, New York.
90. A technique and apparatus for taking intermittent photographs of living embryos to show progress of development. E. P. Fromm, University of Michigan. (Introduced by Peter Okellberg.)

By title

91. The early embryology of the fish *Trichopodus* (*Osphromenus*) *trichopterus*. J. C. Gray, Western Reserve University.
92. The development of the kidney of the fish *Trichopodus* (*Osphromenus*) *trichopterus*. E. Karolyi, Western Reserve University. (Introduced by J. C. Gray.)
93. Direct tympanic membrane formation from dermal-plicae integument. O. M. Helff, New York University.
94. A study of the thyroid in embryos of *Eleutherodaetylus luteolus nubicola*. W. Gardner Lynn, Johns Hopkins University.
95. An ovarian cystadenoma and its influence upon sex differentiation in an immature diamond-back terrapin. Paul L. Risley, State University of Iowa.
96. Origin of asymmetry in the reproductive system of birds. Emil Witschi, State University of Iowa.
97. The storage of trypan blue in grafts of embryonic duck kidney tissue transplanted to the chorio-allantoic membrane of the chick. Carl J. Sandstrom, New York University.
98. The development of chick embryos in a high-frequency electro-magnetic field. Carl J. Sandstrom and Normal Hilberry, New York University.
99. Time of origin and method of formation of thymic corpuscles in the albino rat. Harry A. Charipper and Martin M. Ginsburg, New York University.

100. Differentiation of endodermal derivatives of the rabbit embryo. I. Liver and pancreas. A. J. Waterman, Williams College.
101. Differentiation of endodermal derivatives of the rabbit embryo. II. The lung. A. J. Waterman, Williams College.
102. The course of gestation in the guinea pig. A record of 678 pregnancies. William C. Young, Brown University.
103. Changes in the proportions of the cat fetus during its development. Homer B. Latimer, University of Kansas.

PARASITOLOGY

Read

(Papers 104 to 109, inclusive, form the program for the joint session with the American Society of Parasitologists.)

104. Resistance and susceptibility in coccidial infections. Justin Andrews, Johns Hopkins School of Hygiene and Public Health. (Introduced by R. W. Hegner.) (Lantern; charts; 15 min.)
105. The nature of immunity in coccidiosis. Elery R. Becker, Iowa State College. (Lantern; 15 min.)
106. The effect of an increased burden of phagocytosis upon natural and acquired immunity to bird malaria. Wendell Gingrich, University of Chicago. (Introduced by K. S. Lashley.) (Lantern; 15 min.)
107. The development of adult trichinae in chick and rat embryos. O. R. McCoy, University of Rochester. (Introduced by W. W. Cort.) (15 min.)
108. The interrelations of parasite and host tissue in experimental Strongyloides infection. Ernest Carroll Faust, Tulane University. (Introduced by W. H. Taliaferro.) (Lantern; 15 min.)
109. Experiments on the passive transfer of immunity to an intestinal nematode infection, and its bearing on local immunity. Asa C. Chandler, Rice Institute. (Introduced by F. R. Lillie.) (Lantern; 15 min.)
110. A comparative morphological and physiological study of some haemosporidia of birds. Earl C. O'Roke, University of Michigan. (Lantern; 15 min.)
111. The life history of the black grub of bass, *Crassiphiala ambloplitis* (Hughes). George W. Hunter, 3rd, and Wanda S. Hunter, Wesleyan University. (Lantern; 15 min.)
112. Effect of irradiated ergosterol and calcium lactate on calcification of trichina cysts. W. W. Wantland, Northwestern University. (Introduced by F. D. Barker.) (Lantern; 10 min.)
113. Lung infectibility of laboratory animals with pig and cat *Ascaris*. George L. Graham, Rockefeller Institute for Medical Research. (Lantern; 12 min.)

By demonstration

116. The plerocercoids of *Diphylobothrium latum*. Tennis Vergeer, Hope College. Hope College. (Introduced by George R. La Rue.)
115. *Diphylobothrium laruei* sp. nov. and *Sparganus pseudosegmentatum* sp. nov., two cestodes from the Great Lakes region. Tennis Vergeer, Hope College. (Introduced by George R. La Rue.)

By title

116. The plerocerooids of *Diphyllbothrium latum*. Teunis Vergeer, Hope College. (Introduced by George R. La Rue.)
117. Blood parasites of birds of the Syracuse (N. Y.) region. Reginald D. Manwell, Syracuse University.
118. The question of periodicity in the asexual cycle of *Plasmodium circumflexum*. Reginald D. Manwell and Fruma Wolfson, Syracuse University.
119. Notes on the life cycle of *Ophiotaenia perspicua*, a cestode of snakes. Lyell J. Thomas, University of Illinois.
120. Body weight of snails in health and parasitism. C. T. Hurst, Western State College of Colorado.

CYTOLOGY AND HISTOLOGY

Read

121. Octoploidy and diploidy in *Miastor americana*. Alfred F. Huettner, New York University. (Lantern; 15 min.)
122. The chromosomal origin of spindle fibers. E. Eleanor Carothers, University of Pennsylvania. (Lantern; 15 min.) (Also by demonstration.)
123. The malpighian tubules of *Anisolabis*. S. I. Kornhauser, University of Louisville. (Lantern; 15 min.)
124. Development of the hermaphrodite genital organs of *Valvata tricarinata*. Clarence Lee Furrow, Knox College. (Lantern; 10 min.)
125. The effect of temperature on the vacuome in nerve cells of fish. Ross C. MacCardle, Temple University. (5 min.)
126. Temperature variations and histological changes in the thyroid glands of frogs. Opal M. Wolf, University of Wisconsin. (Introduced by M. F. Guyer.) (Lantern; 7 min.)

By demonstration

127. The chromosomal origin of spindle fibers. E. Eleanor Carothers, University of Pennsylvania. (See abstract no. 122.)
128. The spiral tendency in striated muscle. C. W. Robertson, New York University. (Introduced by M. H. Harnly.)
129. Structure of salivary gland chromosomes in *Sciara*. C. W. Metz and E. H. Gay, Carnegie Institution of Washington and Johns Hopkins University.
130. Cytology of the nephrostome of *Lumbrieus*. Hope Hibbard, Oberlin College.

By title

131. Cytological studies on flame cells in trematodes. Charles H. Willey, New York University.
132. The retention of carbon by the thrombocytes of *Necturus* following intravascular injections of India ink: an indication of the length of life of the thrombocyte. Alden B. Dawson, Harvard University.
133. The cytological changes in the hypophysis cerebri of the garter snake (*Thamnophis radix*) following thyroidectomy. Kenneth Siler, University of Kansas. (Introduced by Homer B. Latimer.)

134. The chromosomes of the male musk turtle, *Sternotherus odoratus* (Latreille).
Paul L. Risley, State University of Iowa.

MORPHOLOGY

Read

135. Some remarks on the freshwater jellyfishes, *Limnocnida* and *Craspedacusta*.
H. B. Fantham and Annie Porter, McGill University. (Introduced by
George R. La Rue.) (Lantern; 10 min.)
136. The pseudosternite of the grasshopper as an aid to classification. L.
Gertrude Morrison, State University of Iowa. (Introduced by R. L. King).
(Lantern; 10 min.)
137. The comparative anatomy of the adrenal-sympathetic complex. Daniel Paul
Quiring, Western Reserve University. (Introduced by A. H. Hersh.)
(Lantern; 10 min.)
138. Factors controlling the form and color of scales on the regenerated tails
of lizards. G. K. Noble and H. J. Clausen, American Museum of Natural
History. (Lantern; 15 min.)
139. The relation of the number of myotomes and vertebrae to the length and
flexibility of the body in fishes. Edward P. Churchill and Harold D.
Kautz, University of South Dakota. (10 min.)
140. The mechanical forces involved in the evolution of the fish body form. John
Edward Harris, Columbia University. (Introduced by George R. La Rue.)
(Lantern; 15 min.)

By title

141. A note on the anatomy and histology of a giant *Necturus*. Emory S.
James, New York University and Miami University. (Introduced by
Edward L. Rice.)
142. The supranasal sac of the Viperinae. W. Gardner Lynn, Johns Hopkins
University.
143. The influence of hereditary dwarfism on the differentiation of the skeleton
of the mouse. Alden B. Dawson, Harvard University.
144. Further studies of the histological variability of human head-hair. Leon
Augustus Hausman, New Jersey College for Women.
145. Homology and its genetic basis. Alan Boyden, Rutgers University.

PROTOZOÖLOGY

Read

146. Cytological studies of the genus *Chilodonella* strand. No. 2. Mary Stuart
MacDougall, Agnes Scott College. (Lantern; 10 min.)
147. Lag in the division time of *Paramecium caudatum*. George A. Smith,
Carnegie Institution of Washington. (Lantern; 10 min.)

By demonstration

148. The conjugation of *Paramecium trichium*. William F. Diller, Dartmouth College. (Introduced by D. H. Wenrich.)
149. An amoeba-like parasite in the malpighian tubules of the grasshopper *Melanoplus differentialis*. R. L. King and A. B. Taylor, State University of Iowa. (No abstract received.)

By title

150. The structure of *Cyttarocylis acutiformis*. Arthur S. Campbell, St. Mary's College.
151. Structure of living zooxanthellae. William L. Doyle, Johns Hopkins University. (Introduced by S. O. Mast.)
152. The function of the neuromotor system in the parasitic ciliate *Ichthyophthirius*. Ronald F. MacLennan, State College of Washington.
153. Relation between the rate of formation of the food vacuoles and the rate of pulsation of the contractile vacuoles in *Paramecium multimicro-nucleatum*. John A. Frisch, Johns Hopkins University. (Introduced by S. O. Mast.)

ECOLOGY

Read

154. Studies on the life cycle and on reversal of symmetry in a fresh water snail, *Campeloma rufum*. Harley J. Van Cleave, University of Illinois. (Charts; 10 min.)
155. The fauna of West Virginia caves. Albert M. Reese, West Virginia University. (Lantern; 10 min.)
156. A study of sedimentation in a glacial lake. Ira T. Wilson, Heidelberg College. (Lantern; 10 min.)

By title

157. A comparison of the values obtained for dissolved oxygen in water, using the Winkler titration method and the manometric Van Slyke method. Charles Brambel and R. P. Cowles, Johns Hopkins University.
158. Studies of the values for dissolved gases, in depth samples of brackish water, collected with a pump and with a special sampling apparatus. R. P. Cowles and C. E. Brambel, Johns Hopkins University.
159. The acidity of the water of a sphagnum swamp. R. P. Cowles and Charles Brambel, Johns Hopkins University.
160. The influence of temperature and other factors on the winter aggregations of the sunfish *Lepomis auitus*. C. M. Breder, Jr., New York Aquarium and R. F. Nigrelli, New York University.

MISCELLANEOUS

Read

161. An inexpensive balanced diet for trout and salmon. H. P. K. Agersborg, National Park Service. (15 min.)
162. Mechanism and specificity of sexual reactions in *Ostrea virginica*. Paul S. Galtsoff, U. S. Bureau of Fisheries. (Lantern; 15 min.)

By title

163. Further observations on adrenal tumor in the frog. W. M. Smallwood, Syracuse University.
164. Pigmentation in its relations with melanosis in certain tropical fishes. H. D. Reed and Myron Gordon, Cornell University.
165. Qualitative and quantitative analyses of foods for salmonids reared artificially. H. P. K. Agersborg, National Park Service.
166. When do the rainbow trout spawn? H. P. K. Agersborg, National Park Service.
167. Aquaculture and agriculture. H. P. K. Agersborg, National Park Service.
168. Comparative resistance of five breeds of chickens to the nematode *Ascaridia lineata* (Schneider). J. E. Ackert, L. L. Eisenbrandt, J. H. Wilmoth, B. Glading, and I. Pratt, Kansas State College.
169. Preliminary report on the pathology of an inherited eye defect in the guinea pig. J. H. Whitlock, Iowa State College. (Introduced by J. E. Ackert.)

ABSTRACTS

An author index for all abstracts will be found on pages 103 to 106.

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

1. EXPERIMENTAL CHANGES IN THE PROTOPLASMIC CONSISTENCY OF AMOEBA.
Douglas Marsland, New York University. (Introduced by H. A. Charipper.)
(Cinema; 12 min.)

Amoebae, subjected to pressure applied to the surface of the aqueous culture medium, show a marked liquefaction of the protoplasm. This is judged by the centrifugal stratification method and by the observation that at a critical pressure (about 6000 pounds per square inch) the cells abruptly assume the spherical form characteristic of liquid systems. The liquefaction develops within a second or so of the compression and is rapidly reversible with decompression. Motion picture records of the changes in cell form when the pressure is quickly developed and released permit a determination of the time involved in these changes.

2. THE FUNCTION OF SULPHUR IN VARIOUS FORMS IN GROWTH IN CHILOMONAS PARAMECIUM. S. O. Mast and D. M. Pace, Johns Hopkins University. (15 min.)

Chilomonas contains much starch, fat and protein. It can synthesize these and protoplasm from inorganic compounds which contain only S, P, K, Mg, C, H, N, O, and possibly very minute traces of other elements. This synthesis is not dependent upon chlorophyll or light. The energy required is probably obtained from oxidation of ammonia.

As the concentration of S increases from zero in sterile solutions consisting of S, Mg, P, K, N, an acetate and water, the rate of fission increases from zero to a maximum of $4 \pm$ divisions per day, then decreases. This obtains for sulfur in the following compounds: Na_2S , $\text{Na}_2\text{S}_2\text{O}_3$, Na_2SO_3 , Na_2SO_4 , cysteine, glutathione reduced or oxidized but the optimum concentration of S varies greatly. It is $0.0006 \pm \text{M}$ for Na_2S and only 0.000033 M for glutathione (HS). There is no consistent correlation between the extent of oxidation of the sulfur and the rate of fission. The maximal rate for reduced glutathione is considerably lower than it is for oxidized, but the opposite obtains for inorganic compounds.

If sulfur is in optimal concentration the fat decreases greatly; if absent it increases greatly. Sulfur is not necessary for synthesis of carbohydrates. It probably functions in the synthesis of proteins and as a catalyst in oxidation.

The results obtained do not support Hammett's contention that "sulfhydryl is the essential stimulus to growth by increase in cell number"; or Jahn's that the action of sulfur is correlated with its effect on the oxidation-reduction potential of the culture solution.

3. GROWTH CHARACTERISTICS AS RELATED TO INITIAL REPRODUCTIVE CAPACITY IN A CLONE OF DAPHNIA. Thelma R. Wood, Lester Ingle and A. M. Banta, Brown University. (Lantern; 15 min.)

In studies upon the growth and reproductive characteristics of a clone of *Daphnia longispina*, correlations were made between 'birth' length (at time of release), 'adult' length (after first parthenogenetic young were produced), age in hours to adult stage, and number in first clutch. Four independent series, consisting of from 70 to 113 vigorous individuals in each series with hourly observations, were used. These correlations indicate that there is no significant relationship between birth length and either number of hours to the adult stage or number in first clutch. There is, however, a small positive correlation between birth length and adult length in two of the series. On the other hand age in hours shows significant and most fairly large negative correlations both with adult length and number in first clutch.

The low values and general lack of statistical significance of correlations in the former group reflect genetic uniformity of the material and a large measure of environmental uniformity up to the time of birth. The larger and statistically highly significant correlations of the latter group indicate environmental effects upon rate of development, adult size, and number in first clutch. The earlier these *Daphnia* reproduce the larger they have become, and the more young they produce. Other correlations show that number in the first clutch is more closely related with the first and second growth increments than with relatively large growth increment (fourth) occurring while the ovarian eggs, which give rise to the first clutch of young are developing.

4. THE ACTION OF SOFT X-RAYS ON CLADOCERA (*DAPHNIA MAGNA*). G. Snider and H. Kersten, University of Cincinnati. (Introduced by H. L. Wieman.) Lantern; 10 min.)

The action of soft x-rays on Cladocera (*Daphnia magna*) was studied from the following three angles: 1) Lethal effect as expressed in time necessary to cause a cessation of heart-beat at a given voltage (biological dosimeter); 2) destruction of eggs; 3) influence of x-rays on development and heredity.

Animals were raised in a modified Banta culture medium and used just after having released their first broods and laid their second brood eggs. Young were used when 1 day old.

The x-ray tube had a copper target and window consisting of 0.045 mm. aluminum and 0.045 mm. cellophane. The wave length of the most intense part of the radiation was 1.54 Å. Dosages varied with type of experiment.

Animals show a killing time of 21 minutes at about 40 K.V., 10 M.A., next to the window.

Eggs, newly laid, in the mother's brood pouch when treated with 20 K.V., 10 M.A., and 5 cm. distance from the window for 40, 60 and 80 seconds show disintegrative changes within 2 days, although the ovary itself is apparently unharmed. Subsequent offspring show no effects.

When 1-day-old animals are irradiated (40 K.V., 10 M.A.) at 5 cm. distance from the window for 25, 45, 55 and 75 seconds, respectively, and are examined at the end of 8 days (room temperature) they show: 1) in the higher dosages,

a distorted carapace and disorganized spines; 2) a decrease in size progressing with increased dosage; 3) an induced sterility varying in degree with length of time of irradiation without at the same time affecting the hereditary constitution. The sterility is transitory.

5. THE RELATION OF CELL SIZE TO GROWTH IN INSECT LARVAE. Wm. Trager, Rockefeller Institute. (Introduced by Norman R. Stoll.) (Lantern; 10 min.)

Larvae of the fleshfly, *Lucilia sericata*, were reared, and at suitable time intervals measurements were made of the length and weight of the maggots and of the length of the cells of several representative tissues. It was found that all the cells (hypoderm, fat, midgut, hindgut, salivary gland, muscle and tracheal matrix) except the brain and blood cells, increased greatly in size. Moreover, this increase was, for the hypoderm, midgut, hindgut, muscle and tracheal matrix cells, proportional to the increase in length of the body. The growth curve for the fat cells followed closely that for the weight of the maggots. These results show that practically the whole growth of larvae of *Lucilia sericata* is a result of increase in the size, not the number, of their cells. In a similar study of silkworms it was found that cells of the nerve ganglia remained the same size, while those of the other tissues increased in size. Only in the case of the muscle cells was the increase proportional to the increase in body length. Silk gland cells increased in length to a greater extent than the body. The other types of cells showed during certain instars an increase proportional to the increase in body length, while during other instars they remained of constant size. The differences in the results with *Lucilia* and with *Bombyx* suggest that larval tissues which are to be histolyzed in the pupa tend to grow by increase in the size of their cells, while those which persist to the imago grow largely through cell division.

6. REGIONAL GROWTH RATES IN INSECTS. Nellie M. Payne, University of Minnesota. (Lantern; 15 min.)

In embryonic life growth is most rapid in the region, next in the thorax, and slowest in the abdomen. The order is reversed in postembryonic life. Before hatching the jumping leg in grasshoppers grows faster than it does after hatching. In the grasshopper, growth in all parts slows down before rotation, whether or not the egg has a diapause. Growth in total length, or total weight when plotted against age forms a sigmoid curve. Growth of some of the individual parts can be expressed by sigmoid curve; growth of others by exponential or power curves not of sigmoid type.

7. DARK ADAPTATION IN EYE OF THE DRONE FLY, *ERISTALIS TENAX*. William L. Dolley, Jr., W. J. Bowen and C. C. Hassett, University of Buffalo. (Lantern; 15 min.)

In a previous paper it was concluded that during exposure to darkness sensitivity to light in the eye of *Eristalis tenax* increases in about 60 minutes to a maximum, remains at this level for 2 hours, then decreases rapidly. This decrease in sensitivity was so surprising that it has been thought since that perhaps it was due to the experimental procedure.

Using different methods another study has been made of the sensitivity of the eye of *Eristalis* after exposure to darkness for various periods. The results of these experiments confirm those published previously and show further that the curve of sensitivity of the eye of *Eristalis* varies with the sex and age of the organism. After exposure to darkness for 60 minutes or less females are more sensitive to light than males, and flies of both sexes up to the age of 15 days are more sensitive than older flies.

8. MECHANISM OF METAMORPHOSIS OF ASCIDIAN LARVAE. Caswell Grave, Washington University. (Lantern; 15 min.)

Data will be presented that have been interpreted as showing metamorphosis of ascidian larvae occurs when a substance (secreted by some larval organ or tissue following hatching) reacts with a by-product of metabolism (produced during larval activity) to produce a third substance, the latter acting directly on the larval nervous system in a way to cause; 1) adaptive changes in responses of the larva to light and gravity; 2) the attachment of the larva, and finally, spasmic, tetanus-like contractions of the muscle bands by which the entire action system of the larva is crumpled, disrupted and withdrawn into the posterior portion of the body. Results of experiments designed to reveal the nature and identity of the several hypothetical substances that constitute this mechanism of metamorphosis, will be stated and discussed.

9. OIL-SOLUBLE AND WATER-SOLUBLE NEUROHUMORS. G. H. Parker, Harvard University. (Lantern; 15 min.)

The dermal color changes of the common dogfish, *Mustelus canis*, depend upon melanophores which disperse their pigment under the action of a water-soluble neurohumor from the pituitary gland and concentrate it under what appears to be pure nerve action. When an oil extract is made from the light parts of a light dogfish and is injected into a dark fish directly under its skin, light spots appear in the region of injection. They are believed to be due to the concentrating action of an oil-soluble neurohumor produced by the nerves and applied to the melanophores.

10. COMMENTS ON THE SO-CALLED RESONANCE PRINCIPLE OF NERVOUS CONTROL. Paul Weiss, The University of Chicago. (10 min.) (Also by demonstration.)

The discovery of the phenomenon of 'homologous function' in transplanted supernumerary limbs (Weiss, '22) and muscles (Weiss, '31) has necessitated the assumption that the mechanism involved in the control of the peripheral organs by the central nervous system is one of specific functional correspondence ('resonance') rather than one of stereotyped connections: the centers would send out specific impulses for the various end organs as the specific receivers. While in the earlier work more emphasis was laid on the muscles and end plates as being the selective receivers, recent experiments suggest, that the whole 'motor unit' (Sherrington), including the motor fiber and its ganglion cell may become selective. This would be due to some specifying influence exerted by the muscle and gradually extending from the muscle centrad over the innervating neurones

down to the spinal cord. The specific sending of impulses would then be confined to the central 'neuropil' (Herrick), comparable to the nerve net of lower animals, and the specific selection would take place in the motor ganglion cells, specified by their respective peripheries by way of the connecting motor fibers. Sensory influences can be ruled out as mediators, since 'resonance' phenomena have been obtained on deafferented animals also.

11. SOME EXPERIMENTS ON HEMOLYSIS. R. Höber, University of Pennsylvania. (Introduced by Robert Chambers.) (Lantern; 15 min.)

Hemolytic experiments with erythrocytes of mammals have shown, that the permeability of the erythrocytes of ox, pig, sheep to a number of organic lipidinsoluble nonelectrolytes and of inorganic anions is a small one in comparison to that of the erythrocytes of man, rat, mouse. On the other hand, the erythrocytes of ox, pig, sheep are easily hemolyzed by special organic anions, which are relatively indifferent in their action on the erythrocytes of man, rat and mouse. Not all kinds of organic anions act in this way, but only those distinguished by hydropolarity or by surface activity. Further, it has been pointed out by potentiometric measurements, that positively charged collodion membrane behaves similar to the erythrocytes of ox, pig, sheep in so far as they show likewise a selective permeability to the hydropolar and surface active organic anions.

12. CELLULAR REACTIONS TO COMPRESSION AND DECOMPRESSION. Dugald E. S. Brown, New York University and Bellevue Hospital Medical College. (Introduced by H. B. Goodrich.) (Lantern; 15 min.)

The response of a muscle fiber involves a series of well-recognized reactions—the local excitatory process and the propagated disturbance associated with the change in state of some surface, the liberation of chemical potential energy in juxtaposition to the contractile element and the re-orientation of the protein components in the fibrillae. Recent studies have shown that pressure alters in a reversible manner the rate and magnitude of these processes and thus provides a new tool for examining the underlying mechanism. Making use of the fact that a system under pressure may be completely decompressed in 0.02 seconds, experiments were performed in which cardiac and striated muscle were decompressed at different moments throughout the contraction cycle. The results show clearly that the effects of pressure are so reversible that a normal contraction follows a decompression interposed coincidentally with excitation. Moreover, at any time later in the contraction the effects are equally reversible, causing the liberation of chemical energy for contraction or the rate of contraction to revert immediately to the prepressure value. Experiments employing a rapid compression also show that the effects on the above processes proceed *pari passu* with the development of pressure. The results indicate that at atmospheric pressure the reaction of the excitatory system, and the process of energy liberation, to one stimulus involves only a portion of the total reactants present. This may be taken as indicating a break down process limited in extent by a process of resynthesis—pressure tending to favor the former.

13. PERMEABILITY OF LIVING CELLS TO HEAVY WATER. Balduin Lueké and E. Newton Harvey, University of Pennsylvania and Princeton University. (Lantern; 15 min.)

A number of investigators have found that heavy water unfavorably affects living material. The present investigation was undertaken to determine whether the injurious effects of heavy water are associated with difference in rate of penetration of heavy water and of ordinary water into cells. For such study cells of spherical shape (unfertilized eggs of the sea urchin) were measured while swelling in hypotonic media containing, respectively, ordinary water, and different concentrations of heavy water. From the data, the amount of solvent that passes into the cell per unit of time, per unit of cell surface and per atmosphere of osmotic pressure could be calculated. No significant or constant difference was found between the rate of penetration of heavy water and of ordinary water. It is therefore concluded that the biological effects of heavy water cannot be explained on the basis of alteration in cellular permeability.

14. FREE AND BOUND CALCIUM IN STIMULATION AND INJURY. L. V. Heilbrunn, D. Mazia, and H. B. Steinbach, University of Pennsylvania. (Lantern; 15 min.)

In attempting to explain the behavior of protoplasm after stimulation, the following scheme has been developed in this laboratory. Stimulation is thought to involve the liquefaction of a calcium gel in or near the cell surface. Calcium ions are then set free, and these produce first a transient liquefaction and then a clotting of the interior protoplasm, a clotting similar to that produced when a cell is torn or injured. In amoeba, there is evidence from viscosity studies that such a series of changes occurs after exposure to ultraviolet radiation or mechanical agitation.

An essential feature of the postulated mechanism is that calcium ion is set free. Direct evidence in favor of this point is now brought forward. In ultrafiltration studies, one of us (Mazia) has been able to show by direct analysis for free and bound calcium that when the sea urchin egg cytolyzes as a result of excessive stimulation, its content of free calcium rises. Moreover, following the stimulus of fertilization there is also an increase in the free calcium content of the cell, although this is not as pronounced as in cytolysis. In scallop muscles, one of us (Steinbach), using the same technique has shown that following injury there is a rise in free calcium. These observations verify predictions based upon the scheme previously outlined.

15. THE MECHANISM OF CYTOPLASMIC FISSION IN AMOEBE PROTEUS. H. W. Chalkley, U. S. Public Health Service. (Lantern; 15 min.)

Cytoplasmic fission in *Amoeba proteus* is considered to be a special phase of locomotion, and the phenomena observed under both normal and abnormal environmental conditions are explained on the assumption that Mast's theory of amoeboid locomotion obtains.

16. PARTHENOGENESIS IN ASTERIAS EGGS BY MEANS OF IODINE-CONTAINING COMPOUNDS. Alvalyn E. Woodward, University of Michigan. (Lantern; 15 min.)

Iodine brings about parthenogenetic development of *Asterias* eggs similar to that found by Doctor Hague and the writer in *Arbacia* eggs. In addition, development to swimming gastrulae will result if the eggs are treated with extracts of desiccated thyroid glands or with solutions of thyroxine or calcium iodide. This is in accord with Carter's statement that the effect of thyroxine on *Echinus* sperm and eggs resembles that of egg secretions.

17. ELECTRO-MEASUREMENTS OF THE PERMEABILITY OF THE GRASSHOPPER EGG MEMBRANE. Theo. L. Jahn, State University of Iowa. (Lantern; 10 min.)

Diapause eggs of *Melanoplus differentialis* were impaled at the micropyle end by a glass capillary filled with saturated KCl. The wounds were sealed with paraffin, the eggs were immersed in a salt solution, and the potential of the system, i.e., sat. KCl/salt sol./membrane/yolk/sat. KCl, was measured with a vacuum tube potentiometer. By changing the concentration of the salt solution it was possible to measure the theoretical system, sat. KCl/x conc. salt/membrane/yolk/membrane/y conc. salt/sat. KCl. Results are as follows:

1. Equilibrium values were established within 2 to 10 minutes.
2. The membrane is more permeable to K than to Cl or SO_4 ions.
3. No appreciable difference could be found between permeability to Cl and SO_4 ions.
4. Magnitude of the E.M.F. with KCl in concentration ratios of 1/2 varies with the concentration. In one series of experiments the difference between M and M/2 was 0.9 mv.; between M/512 and M/1024, 14.8 mv. In lower concentrations the differences again decreased. Transfer numbers calculated for Cl⁻ in this experiment decreased with dilution from 0.474 (M to M/2) to a minimum of 0.077 (M/512 to M/1024) and increased anomalously with higher dilutions. These results indicate that the relative permeability to K and Cl⁻ at high concentrations is almost equal and that relative permeability to Cl⁻ decreases with dilution. The anomalous increase in transfer number in very high dilutions is probably caused by the indirect method of measurement.

18. CONCERNING THE EFFECT OF NUMBERS PRESENT ON FIRST CLEAVAGES AND EARLY DEVELOPMENT IN ARBACIA. W. C. Allee and Gertrude Evans, Marine Biological Laboratory and The University of Chicago. (Lantern; 15 min.)

Relatively crowded drop cultures of *Arbacia* eggs take less time for development to 50 per cent first or second cleavages and are in better condition the morning following fertilization than are accompanying cultures containing few eggs. One to forty eggs in drops of 10 to 20 mm.³ were regarded as sparse populations; crowded drops contained up to approximately 8000 eggs per 20 mm.³ Ninety paired experiments, selected only for excellence of cleavage, showed a mean retardation of 0.91 minutes in time to 50 per cent first cleavage; the statistical probability of 0.045 approaches the conventional upper limit of statistical significance. By second cleavage, this difference had increased to 2.24 minutes with the high statistical probability of >0.0000 . In 117 paired experiments in which

the cleavage, though good, did not always reach so exacting a standard, eight-five showed cleavage retardation in the sparser populations; fifteen gave reversed results, and seventeen showed no difference between crowded and sparse cultures. In the fifty-five paired experiments followed for over 18 hours after fertilization, forty-seven denser cultures were in better condition as determined by state of development and comparative mortality; in four, conditions were reversed, and four showed no difference. Effects of over-crowding can be demonstrated readily and we know that isolated eggs will develop to the pluteus stage in 0.5 cc. of water; under the conditions of our experiments, however, retardation in first cleavages and in early development appears to be demonstrated for sub-optimal populations. No explanation is advanced pending further experimentation.

19. CHEMICAL HIBERNATION IN HEAVY WATER OF LOW CONCENTRATION. T. Cunliffe Barnes and E. J. Larson, Yale University. (Introduced by George A. Baitsell.) (Lantern; 10 min.)

The introduction of the heavy hydrogen isotope, deuterium, into living organisms exposed to heavy water affords a new method of controlling physiological processes in the organism as a whole. Flatworms, *Phagocata gracilis*, were kept for long periods in 0.06 per cent and higher concentrations of heavy water (50 cc. in Petri dishes with 1 drop of Ringer's solution per 10 cc.), with controls in ordinary water. After a few months' time the control animals showed the usual shrinkage in body size, being one-fifth or less of their original size, while the worms in heavy water showed only a slight diminuation in size. The reduced activity of pancreatic amylase incubated in the same heavy water suggests that the striking differences in body size was a result of the slowing down of auto-digestion in the animals in heavy water. The greater length of life of plant cells in the heavy water can be interpreted along similar lines.

20. OXYGEN TENSION AND URINE PRODUCTION IN FROGS. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)

The object was to relate water excretion with circulatory changes and oxygen supply in the kidneys. It was previously found that lack of oxygen stopped the formation of urine in frogs and stopped the flow of blood through the renal glomeruli. Comparisons were now made of rates of urine formation and of blood flow through the glomeruli in frogs with brain destroyed and one ureter cannulated. In 50 per cent oxygen the rate of urine excretion was not much decreased as compared with that in one atmosphere (100 per cent oxygen), but in room air (21 per cent oxygen) and lower tensions it was very slow. The glomerular blood flows were not visibly different in oxygen tensions between pure oxygen and room air; only in lower tensions were they slowed or stopped. Similarly the aortic blood pressure and the heart rate were not reduced except in tensions of oxygen below room air (and then only by small amounts). Instances were found in which glomerular blood flow persisted yet no urine was formed. In normal intact frogs, by virtue of their breathing, oxygen supply and urine rates were little changed in tensions above room air; in lower tensions the response varied in individuals and on the average declined rapidly with oxygen

tension. The reduction of blood flow was primarily due to constriction of renal arterioles, and this factor may have also reduced the blood pressure in the glomerular capillaries, thus decreasing the pressure and rate of filtration from the blood plasma.

21. THE EFFECTS OF VARIOUS CARBON DIOXIDE TENSIONS ON THE BEATING OF THE LATERAL WALLS OF THE GRASSHOPPER EMBRYO, *MELANOPLUS DIFFERENTIALIS*. J. F. Walker, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 8 min.)

Grasshopper embryos treated with CO_2 concentrations from 2.7 per cent to 100 per cent show an over-shooting of the normal beating rate of the lateral walls upon subsequent exposure to air. This higher rate of beating continues approximately 40 to 60 minutes and is not due to oxygen lack since: 1) it occurs in embryos after exposures to CO_2 mixtures rich or poor in oxygen; 2) the normal rate of beat can be maintained by 3 to 6 per cent oxygen; 3) degree of over-shooting is practically unaffected by time of exposure to gas mixtures. Apparently rapid CO_2 diffusion from the embryo causes over-shooting since: 1) when the beating is stopped by commercially pure CO_2 , it starts again upon subsequent exposure to pure nitrogen; 2) 12.4 to 95 per cent CO_2 solutions will stop the beating, yet recovery may take place in these solutions. When recovery takes place in a 60.6 per cent solution its replacement by a 46 per cent solution results in acceleration.

Plotting time of recovery in different concentrations of CO_2 against concentration gives a straight line up to 83 per cent where the curve turns sharply upward. Embryos recovering in relatively low CO_2 concentrations may become so acclimated to CO_2 that subsequent exposure to 82 per cent may fail to stop the beating.

The bicarbonate concentration is equivalent to approximately 2.23 cm.³ per 100 gm. of egg.

Pure CO_2 exerts its maximum effect within 10 minutes.

22. THE RESPIRATORY METABOLISM OF *GALLERIA MELLONELLA* (BEE MOTH) DURING METAMORPHOSIS AT DIFFERENT CONSTANT TEMPERATURES. Frederick Crescitelli, Brown University. (Introduced by H. E. Walter.) (Lantern; 15 min.)

The effects of temperature on the rate of oxygen consumption, the rate of carbon dioxide production, the respiratory quotient, the total oxygen consumed, and the total carbon dioxide produced during the pupal period of the bee moth (*Galleria mellonella*) have been studied. The respiratory exchange has been investigated by means of differential manometers at each of the following temperatures: 20.0°, 25.07°, 30.05°, 35.0°, 37.5° and 39.97° C. The usual U-shaped type of pupal metabolic curve, modified by the presence of a terminal drop immediately before emergence, has been obtained for each temperature studied. A metabolic sex difference similar to that already described by Taylor and Steinbach has also been found to occur at each temperature. The general level of pupal respiratory metabolism has been found to be a function of temperature. An increase in temperature up to 37.5° C. results in an increased rate of either oxygen consumption or carbon dioxide production. Increase in temperature

beyond 37.5° C. is followed by a decrease in the rate of gaseous exchange. The respiratory quotient is practically constant (an average value of 0.69) throughout pupal life. This is true for each temperature studied except 20.0° C. where indications of a slight decrease in the quotient (to 0.68) occur. The total amount of oxygen consumed or carbon dioxide produced during the entire pupal period is not constant for all temperatures but is at a minimum at 30.0° C. Above and below 30.0° C. the total exchange increases regularly.

23. APPLICATION OF THE DALE ANAPHYLACTIC TEST TO STUDY OF ZOÖLOGICAL SPECIFICITY. Paul A. Moody, University of Vermont. (Introduced by Henry F. Perkins.) (Lantern; 10 min.)

A young virgin female guinea pig is sensitized, either actively or passively, to a given protein, serum, for example. The uterus is excised and a strip of it so suspended in oxygenated Locke-Ringer solution at 37° C. that a writing lever is operated upon a kymograph. When a dilution of the protein to which the guinea pig was sensitized is added to the Locke-Ringer bath the resultant smooth muscle contraction produces a tracing, the characteristics of which are ascertained by comparison with the tracing of the same bit of tissue in response to histamine. Other strips from the same uterus are then tested with successive dilutions of the protein and an end point thereby established. Similar tests employing dilutions of a related protein are also carried to an end point, using other strips from the same uterus; subdivision of a uterus into eight strips is practicable. The ratio of homologous end point to heterologous end point forms a measure of the relationship of the proteins.

This test is of greater sensitivity and specificity than is the precipitin test. Its great specificity, however, precludes its use with any but closely related proteins or sera; when relationship is more distant there is no group reaction whatsoever. Aside from somewhat greater objectivity, the test supplements the precipitin technique at the point where the latter is least applicable: distinguishing between closely related proteins or sera—in the case of the present investigation the sera of various species within the genus *Peromyscus*, deer mice.

24. THE EFFECTS OF SEVERE AND PROLONGED VITAMIN E DEFICIENCY IN THE CHICK. F. B. Adamstone, University of Illinois. (Lantern; 15 min.)

After prolonged feeding on a diet treated with ferric chloride to destroy vitamin E, chicks develop a whole series of fatal disorders. At the end of approximately 1 month a condition of imbalance and loss of muscular control may appear accompanied by degenerative changes in the cerebellum. Recovery sometimes occurs spontaneously but after this time a variety of lesions appear in the visceral organs. These have the form of white spots, enlarged nodules or sometimes gelatinous tissue masses associated with the affected organ. Histologically they represent foci of degeneration and destruction of normal tissue accompanied by replacement and invasion by a new cell growth. The latter appears to originate from a variety of sources, e.g., the endothelium of the blood vessels or the tissues of the affected organ and in its undifferentiated state has the form of a delicate reticular syncytium. Occasionally the new cell growth may develop as an extraneous tissue mass of considerable size often

involving several separate organs and simulating a malignant condition in its relation to them. In the latest stages of E deficiency, extensive ulcers develop in the intestine.

The whole series of effects appear to be due to unrestricted and uncontrolled cell proliferation accompanying injury to the nucleus of the cell. It would appear, therefore, that vitamin E is so essential to the maintenance of the normal nuclear condition in the cell that it acts indirectly as a control over cell division.

25. THE VARIABILITY OF THE ERYTHROCYTE COUNT IN THE INDIVIDUAL. Thomas B. Magath, Joseph Berkson and Margaret Hurn, Mayo Clinic. (Lantern; 15 min.)

A great deal has been written on the subject of the average values and variability of the erythrocyte count among different individuals of various defined groups. In spite of many analyses, none seems to adequately express the variability to be expected in counts made successively on the same individual. We have examined each of several factors that can be expected to affect a variation of one count from another and have established quantitatively the measure of this variability, utilizing appropriate statistical technique, after developing a photographic and electrical method of recording the counts. The variations studied were, a) that which occur in the hemacytometer field counted, b) different samples from the same pipette, c) different pipettes of the same sample, d) multiple samples simultaneously taken from the same person.

We found that the normal variability is much greater than is generally assumed in the literature. So much so that the instructions in the standard texts for counting erythrocytes require an agreement of results altogether unattainable if the counts are made without bias. The conclusion reached is that in attempting to meet these impossible standards of agreement, counts are erroneously reported, and evidence of this is presented.

By demonstration

26. STIMULATION OF THE BARNACLE, *BALANUS BALANOIDES*, BY NaCl , Na_2SO_4 , NaNO_3 , GLUCOSE AND UREA. William H. Cole and James B. Allison, Rutgers University. (Charts.)

The character and magnitude of the response to these substances are correlated with concentration. The lowest concentrations for each substance produce increased opening of the valves as compared with the number of regularly active animals in normal sea water, while the higher concentrations produce closure of the valves. In the case of the salts, stimulation as measured by per cent closure is primarily correlated with equivalent concentration. There is, however, a slight difference in effectiveness due to the differences between the three ions. For example, the threshold concentrations for closure by the salts are: NaCl , 0.051 N; Na_2SO_4 , 0.062 N; NaNO_3 , 0.063 N, and the recovery from continued stimulation is much greater for NaNO_3 than for NaCl . Stimulation by glucose and urea is correlated with the molar concentration, no specific difference between them having been demonstrated. The threshold concentration for glucose and urea is 0.075 M. For all five substances the following general equation for

a symmetrical S-shaped curve describes the relationship between per cent closure and concentration:

$$\text{Per cent closure} = \frac{M e^{b(C-a)}}{1 + e^{b(C-a)}}$$

where M, b and a are constants differing only slightly for the different substances, and C = concentration. Therefore it is likely that only one group of receptors is concerned in the responses of the barnacle to these substances. Further evidence on this point was obtained by the use of mixtures of the salts with themselves and with the non-electrolytes. The per cent closure found experimentally for each mixture agreed very closely with the value calculated from the respective equations.

27. CORRELATION BETWEEN DINOFLAGELLATE POPULATION OF SEA WATER AND BEHAVIOR OF THE BARNACLE, *Balanus balanoides*. James B. Allison and William H. Cole, Rutgers University. (Charts.)

Although the barnacle, *Balanus balanoides*, has become one of the most important experimental animals for studies on chemical stimulation, there are frequently periods when they cannot be used successfully because of irregularity of cirral movements. There are times when only a few animals are open in normal sea water freshly pumped from the ocean, and of these most of them are irregular. Previous work has shown that irregularity in cirral movements and closure of the valves may be experimentally produced by adding organic substances to sea water. Other observations have indicated that irregularity of animals in normal sea water was caused by certain organic substances in solution in the sea water, and the possibility that these substances might be contributed by the disintegration of micro-organisms has been suggested. A study was therefore made of the micro-organic population of sea water at Mt. Desert Island over a period of 34 days during the summer of 1934. The results of this study show an apparent correlation between number of animals closed and irregular with the number of dinoflagellates in the sea water. There is no correlation, however, between the total solid content of the sea water and the behavior of the barnacle.

28. REGIONAL GROWTH RATES IN INSECTS. Nellie M. Payne, University of Minnesota.

See abstract no. 6.

29. EMBRYONIC ANOMALIES IN EMBRYOS OF *MELANOPLUS DIFFERENTIALIS* FOLLOWING X-IRRADIATION. Titus C. Evans, State University of Iowa. (Introduced by J. H. Bodine.)

Early undifferentiated embryos irradiated with lethal doses of x-rays produce a large percentage of abnormal embryonic structures. The first effect noted was cessation of growth of parts; later a renewed, although abnormal, growth followed, producing aberrant structures. Embryos irradiated in later developmental stages show abnormalities which were more localized. In general, these abnormalities were duplications or subdivisions of recognizable appendages, while others resulted in structures unlike any organs of the normal grasshopper embryo.

30. APPLICATION OF THE DALE ANAPHYLACTIC TEST TO STUDY OF ZOÖLOGICAL SPECIFICITY. Paul A. Moody, University of Vermont. (Introduced by Henry F. Perkins.)

See abstract no. 23.

31. TYPES OF OVARIAN INJURY FOLLOWING X-IRRADIATION IN GUINEA PIGS. Ida T. Genther, University of Cincinnati.

Following a minimum sterilization dose of x-rays, the ovaries, in most instances, become a solid mass of glandular tissue, which resembles luteal tissue but does not degenerate. No follicles are present, except a few primordial ones. Occasionally one develops to a large size, but also degenerates to form glandular tissue. The presence of such a large follicle is accompanied by prolonged oestrous openings, with continued cornification, and by marked proliferation of mammary gland tissue and growth of the nipples.

In a smaller number of ovaries, the majority of follicles are also destroyed, but no glandular tissue is formed. At irregular intervals, a follicle matures, but degenerates instead of ovulating. The oestrous periods are prolonged and indefinite, the vaginal smears showing leucocytes and epithelial cells, not cornified. See also abstract no. 57.

32. A METHOD OF CULTIVATING TISSUE FROM GRANULATING WOUNDS IN THE ADULT DOG. Margaret R. Murray and Clay Ray Murray, College of Physicians and Surgeons.

For purposes of later experiment we desire to reproduce as closely as possible in tissue culture the conditions obtaining in a healing wound. This makes it especially desirable to dispense with embryonic extract as a growth stimulating substance. This can be done, in this tissue, by the use of an extract made from adult spleens (not necessarily from the same species).

The method of obtaining the granulation tissue is to remove a slip of muscle from each side of the vertebral column and insert short lengths of glass tubing into the cavity thus formed; then close the wound. After 10 to 14 days the tubes, now infiltrated with granulation tissue, are removed and irradiated with ultraviolet (one-fourth to one-half erythema dosage) before being explanted. The irradiation greatly diminishes the percentage of infections, which has been the chief problem in the cultivation of early granulation tissue. Growth is sturdy and rapid, involving mainly fibroblasts and macrophages. So far as our knowledge extends, granulation tissue has not before been cultivated in vitro.

By title

33. AN ALTERNATIVE METHOD FOR THE EVALUATION OF THE INTERFACIAL TENSION BETWEEN OIL AND PROTOPLASM WITHIN LIVING CELLS. Frederick Seitz and Herbert Shapiro, Princeton University. (Introduced by E. N. Harvey.)

In a previous communication, Harvey and Shapiro (J. Cell. Comp. Physiol., vol. 5, p. 255, '34) described a method for the estimation of the interfacial tension between protoplasm and oil within living egg cells of the mackerel, consisting

essentially of the application of sessile drop equations to the profile of the oil drop when flattened by centrifugal force, and photographed in the centrifuge-microscope. Since the droplet contour is determined by a balance between surface forces and internal pressure, the photographs may be used for determining the nature of these surface stresses, assuming that they arise from tangential tension. The equation of static equilibrium was developed and measurements made of the contour to determine whether the droplet obeys this equation at all points on the surface. Space does not permit a detailed discussion of the functions involved in this treatment. The curvature function was plotted for four cases, and in one case the measurements fitted a definite curve which yielded a value of 0.7 dyne/cm., in essential agreement with that of 0.6 dyne/cm. previously determined. The irregularities in the curves for other cases may be traced to the inaccuracies of measurement, a result of the indefiniteness in outline of the droplet. The form of the curves indicates that surface and not elastic forces are involved.

34. AN ELECTROMETRIC STUDY OF THE REDUCING INTENSITY OF LUMINOUS BACTERIA.

Irvin M. Korr, Princeton University. (Introduced by E. N. Harvey.)

Using a vacuum tube potentiometer (modified Dubois circuit) easily reproducible potentials (—209 to 215 mv. at pH 7.6 calculated for normal H electrode) were obtained at electrodes immersed in suspensions of the marine form *B. fischeri* in M/4 phosphate buffer plus nutrient in a N_2 atmosphere. Potentials dropped to maximum negativity within 6 to 7 hours, maintaining this potential for a few hours or arising abruptly. Gold electrodes were generally slower than Pt but ultimately reached the same value. Variations in bacterial concentration above a certain minimal concentration influenced the rate of potential drop but not the final potential. In relatively dilute suspensions the rate of potential drop was so slow that marked cytotoxicity (due to long exposure to anaerobiosis) set in before maximum negativity was reached. In all experiments approximately constant bacterial concentrations were used. The characteristic (most negative) potential was obtained whether approached from a more positive or more negative direction. Bacteria dimmed by heating to 38 to 41°C. for 10 minutes before use, or by culturing at 33 to 34°C., although respiring at reduced rates, produced normal potentials. Higher temperatures have not yet been tried. Urethanes in concentrations which reduced luminescence alone or both luminescence and respiration, did not affect the potential or rate of drop unless their concentrations were so high as to increase markedly the rate of cytotoxicity, whereupon relatively positive potentials were obtained. Iodoacetic acid inhibited luminescence, respiration and potential drop. Other agents are now being tried.

35. THE RELATION BETWEEN TEMPERATURE, KIND AND CONCENTRATION OF SALTS, HYDROGEN ION CONCENTRATION AND RATE OF INGESTION IN AMOEBA PROTEUS.

R. A. Fennell, Johns Hopkins University. (Introduced by S. O. Mast.)

The food (*Chilomonas paramecium*) was cultured in sterile glucose peptone solution. The amoebae were washed in distilled water, left for 12 hours to starve, then put into solutions containing a given number of chilomonads, and left respectively 15-, 30-, 60- and 120-minute periods, after which the number of chilomonads in the food vacuoles were counted.

As the temperature increases the rate of ingestion increases to a maximum at $25^{\circ}\pm$, decreases to a minimum at $30^{\circ}\pm$, then increases to a maximum at $35^{\circ}\pm$, and then decreases to zero at $38^{\circ}\pm$.

In solutions of sodium salts (0.002 N) as the H-ion concentration decreases the rate of ingestion remains constant from pH 5.0 to 8.1, and then rapidly decreases to zero. In solutions 0.005 N it remains constant from pH 5.0 to 6.0, and then decreases to zero at pH 7.6.

In solutions of potassium salts (0.002 N) as the H-ion concentration decreases the rate of ingestion increases from zero at pH 4.9 to a maximum at pH 5.0, then decreases to zero at pH 6.8. In solutions (0.005 N) the range extends from pH 4.7 to 6.4.

In solutions of sodium, potassium or calcium, as the concentration increases the rate of ingestion increases to a maximum at 0.008 N then decreases to zero at 0.03 N; in solutions of potassium it increases to a maximum at 0.008 N and then decreases to zero at 0.01 N, and in solutions of calcium it increases to a maximum at 0.0001 N and then decreases to zero at 0.005 N.

36. THE EFFECT OF POLARIZED LIGHT ON BUDDING RATE OF HYDRA. E. H. Behre, Louisiana State University.

Preliminary studies on various species of laboratory-acclimated Louisiana hydra living under polarized light seem to indicate that polarized light tends to cause these hydra to bud more rapidly than is the usual rate under like conditions of food and temperature with normal lighting. The buds, however, do not break off as quickly as usual, many individuals actually carrying as many as four buds at once, as against a maximum of two in the controls. It is unlikely that this is a genetic character, since the experimental material was collected at random from many sources; but investigations on hydra budded from one parent are now under way, and though the numbers have been few the earlier results hold good so far. Put back into normal laboratory light conditions, the experimental animals very quickly lose their buds, giving a sudden increase in the total number of individuals of the experimental stock.

Results so far seem to indicate that there are seasonal fluctuations in this response to polarized light not unlike those in budding rate of stock under normal lighting conditions. The experiments so far have run too short periods to test the effect of polarized light on any phase of sexual reproduction.

37. ANALYSIS OF THE PROTECTIVE VALUE OF BIOLOGICALLY CONDITIONED FRESH WATER FOR THE MARINE TURBELLARIAN, PRO CERODES. IV. THE EFFECT OF CALCIUM. R. B. Oesting and W. C. Allee, Marine Biological Laboratory and The University of Chicago.

In a series of analyses Allee has shown that, other conditions, including total electrolytes, being equal, Procerodes resist cytolysis longer in extremely hypotonic water if the water has been biologically conditioned than if such conditioning is lacking. Contact of fresh water with living or dead members of the same or of widely differing species has protective value not associated with increased organic content or with the readily tested fractions thereof. The present studies demonstrate that an increase in the calcium content of a solution, within limits,

protects *Procerodes* isolated therein. The protection is greater than that furnished by the increased osmotic value of the solution although as previously reported protection of an osmotic nature can be demonstrated. The increase in the calcium content of water biologically conditioned by the presence of living fresh water planarians or by the addition of a water extract from heat-killed *Procerodes* is adequate to explain the observed protection of *Procerodes*. In the presence of sufficient calcium, biological conditioning does not further increase the protective value of the medium.

38. HISTOLOGICAL STUDIES ON THE MARINE TURBELLARIAN *PRO CERODES WHEATLANDI* EXPOSED TO BIOLOGICALLY CONDITIONED AND OTHER SIMILARLY HYPOTONIC WATER. Lillian Henderson Fowler, Marine Biological Laboratory and Louisiana Polytechnic Institute. (Introduced by W. C. Allee.)

Certain studies of differential survival time of *Procerodes* upon exposure to hypotonic solutions are supplemented by a histological examination. The *Procerodes* used for this study were taken from Allee's experiments, the physiological results of which are recorded in his 1933 paper in *Physiological Zoölogy*. An effort has been made to picture, by means of descriptions and illustrations, the typical histological changes which occurred in worms exposed to various hypotonic solutions, and to establish a sequence of tissue disintegration. A comparison of the state of preservation of the tissues of worms exposed to hypotonic sea water with the tissues of worms from hypotonic biologically conditioned water of comparable electrical resistance shows that the worms from the biologically conditioned solutions were in better state of histological preservation after comparable exposure. The epidermis, gut, muscle and reproductive structures were in more advanced stages of disintegration in the worms from the non-conditioned media. This study does not present a further explanation of the phenomena, but serves to give a histological picture of internal changes in *Procerodes* which have been exposed to hypotonic solutions, and supports the evidence and conclusions of Allee which were based on easily observed changes in the epidermis.

39. FURTHER DATA ON INDUCED PROLONGATION OF LIFE IN *DAPHNIA LONGISPINA*. Lester Ingle, Brown University. (Introduced by A. M. Banta.)

Further experimentation bears out earlier observations that *Daphnia longispina* reared in manure infusion medium of an optimum concentration (normal) have a shorter duration of life than those which have been starved by dilute medium.

The purpose of the present series was to determine the influence of rate of growth, as indicated by increase in body length, on longevity. A series of young was cultured in dilute medium until after the release of their first brood of parthenogenetic young and then placed in normal medium for the remainder of their life. Well-fed animals grow very little after the thirteenth instar, and since these animals were placed in normal medium at the beginning of the sixth instar, they were starved practically half of their normal growing life. They were at that time less than three-fourths the length of the well-fed mothers. There ensued a period of relatively rapid growth, but their average maximum length did not quite reach that of the well-fed mothers. At first the reproductive

rate of the normals was greater, but beginning with the tenth instar the average number of young per instar was greater for the early-starved than for the well-fed mothers. The average longevity for those in normal medium was 28.2 days, for the early-starved 32.24 days, and for those starved throughout life 38.46 days.

40. TO WHAT EXTENT IS DEVELOPMENTAL BLOCK DEPENDENT UPON METABOLIC ACTIVITY OF EMBRYONIC CELL. J. H. Bodine, State University of Iowa.

Advantage has been taken of the normally occurring developmental block in the egg of the grasshopper, *Melanoplus differentialis*, to determine the extent to which the oxygen consumption rate can be modified without in any way interfering with the inherent cellular blocks. Since the egg is covered with an almost completely semi-permeable covering, dehydration through hypertonic balanced salt solutions is easily accomplished. By using hypertonic solutions of different osmotic pressure values the rates of water exchange may be varied while the accompanying changes in oxygen consumption rates are at the same time easily followed. It is also possible to obtain definite information as to the effects of osmotic pressure changes on the oxygen consumption rates of cells in which body movement, cellular activity, etc., are almost completely absent. Briefly it has been possible to show, 1) that the block mechanism in the developing egg of *Melanoplus differentialis* is not primarily concerned with the general oxidation metabolism of the cell, and 2) that the oxidation limits of the blocked cells may be modified without interfering in any way with the working of the block mechanism.

41. STUDIES ON THE RHYTHMIC ACTIVITIES OF EMBRYOS (ORTHOPTERA). Vincent Thompson, State University of Iowa. (Introduced by J. H. Bodine.)

The rhythmic contractions of the lateral body walls of *Melanoplus differentialis* and *Melanoplus femur-rubrum* embryos have been observed from the time of their initiation until after hatching. These contractions commence during blastokinesis and are synchronous with the beating of the heart when it appears. The chronological history of these movements may be divided into three periods: 1) from blastokinesis to yolk engulfment, in which the movements are slow, being of the order 15 to 20/minute at 25° C., are at times irregular, and may even exhibit reversibility in direction of movement; 2) from yolk engulfment to about hatching time, in which the rate of the contractions increases rapidly to 120 to 150/minute, showing almost a linear relationship with time; and 3) a period during which this high rate of contraction is maintained fairly constant. The temperature range over which this activity occurs increases by 8° C. Temperature coefficient values change as the embryo advances in age. Contractions of embryos kept at higher temperatures show a more rapid rate than those which have been allowed to develop to the corresponding developmental state at a lower temperature, and then exposed to the higher temperature. Embryos developing at higher temperatures hatch at younger stages than those held at lower temperatures.

42. DESICCATION AND SURVIVAL OF THE JAPANESE BEETLE (*POPILLIA JAPONICA* NEWMAN). D. Ludwig, New York University.

First-, second- and third-instar larvae, prepupae and pupae of the Japanese beetle were placed in vials at 25° C. A study was made of the rate of desiccation, percentage of survivors, and the loss of weight of the survivors during metamorphosis.

The rate at which various stages became desiccated decreased in the following order: first-, second-, third-instar larvae, late prepupae, early prepupae and pupae. The larvae can survive desiccation until their weight is 50 per cent of its original value. This figure represents the maximum amount of desiccation at which complete recovery was obtained. For the other stages these values are: early prepupae, 56 per cent; late prepupae, 66 per cent; and pupae, 70 per cent.

During normal metamorphosis, there is an average weight loss of 66.5 mg. and 76.1 mg. accompanying the emergence of male and female beetles, respectively. This weight loss is due primarily to a loss of water. When early prepupae were desiccated, the males lost an average of 58.9 mg. and the females 70.1 mg. on emergence. When early pupae were desiccated, emergence was accompanied by an average loss of only 34.7 mg. in the male and 39.5 mg. in the female. The adult beetles contain the normal amount of water regardless of whether they had been previously desiccated in the larval, prepupal, or pupal stages. This water content is restored by a loss of less water at the time of emergence.

43. THE PHOTOMECHANICS OF THE MATING ATTRACTION IN THE FIREFLY. John B. Buck, Johns Hopkins University. (Introduced by S. O. Mast.)

Mast and others demonstrated that in the firefly *Photinus pyralis* the male is directed to the female by alternate flashes of the two sexes, but they did not ascertain how the male distinguishes between the flashes of the female and those of other males. The factors involved in this discrimination were investigated by substituting a flashlight for the female and varying the color, duration, intensity, interval, position and motion of the light. The following conclusions were reached: 1) The male may under suitable conditions be made to respond to the light of another male, or to an artificial source differing widely in color, duration, intensity, etc., from the light of the female, thus showing that no possible difference in the light emitted by the two sexes is operative in the discrimination. 2) The interval between the flash of the male and that of the female is invariably 2 ± 0.2 sec. This is the essential if not the only factor involved in the discrimination. 3) Fireflies of either sex respond only to wavelengths longer than 5300 Å and the sensitivity extends into the infra-red. This range of color vision is strikingly different from that observed in other insects. 4) Males with only one functional eye orient accurately in the air. 5) Some of the above results were confirmed on another species, *Photuris pennsylvanica*.

44. THE EFFECT OF LIGHT ON THE ORIENTATION AND STABILITY OF YOUNG PLECTOGNATH FISHES. C. M. Breder, Jr., New York Aquarium, and John E. Harris. University of Cambridge.

Small specimens of *Stephanolepis* and *Lactophrys*, if exposed to a beam of light, frequently exhibit somersaulting or rotational movements of great rapidity. Somersaulting is produced by passing the locomotor waves in opposite directions along the dorsal and anal fin; the alternative rotational movement is accompanied by the deflection of the dorsal and anal fins to opposite sides of the body, the direction of motion of the undulations being anteroposterior in both fins. Various combinations of fin movements may occasionally give other twisting gyrotory movements. The primary response to light is always an attempt at reorientation of the animal so that the light is incident upon the dorsal surface, as under normal conditions of life.

In fish kept in complete darkness and 'sensitized' by repeated stimuli, gyrations may continue after the light has been removed, and even mechanical stimuli may initiate similar paroxysms. Apparently the equilibrating system is more or less permanently deranged under such circumstances.

Specimens of *Stephanolepis* over 50 mm. in length do not usually display this behavior, and species other than plectognaths show it very feebly or not at all. The observations would seem to indicate that the integration of gravitational stimuli into the behavior pattern is not perfectly attained until a comparatively late stage in the fish's existence, but that light is the primary orienting factor. The gyrations are apparently due to instability, consequent upon over-correction.

45. SEX RECOGNITION IN THE VIVIPAROUS POECILIID *LEBISTES RETICULATUS*. C. M. Breder, Jr., and C. W. Coates, New York Aquarium.

The sexually active males of *Lebistes reticulatus* Peters, will attempt fertilizing a variety of objects. Males isolated for 1 week reacted positively to: females exposed in the same aquarium; in an adjacent aquarium not more than 15 cm. distant; anesthetized females; males; specimens of *Cyprinodon variegatus*; *Fundulus heteroclitus*; *Barbus conchonus*; and the projected shadows of living fishes on the side of the aquarium; but not to carefully made models of females, either moving or still; a mirror outside of aquarium (apparent distance too great?); nor to females behind opaque but perforated screens. Vision alone, consequently, accounts for the observed behavior. It is inferred that discriminative sex recognition does not exist, as such, but any object of appropriate size will stimulate the mating instinct if showing the characteristic motions of a living fish, which are difficult to imitate in a small model.

Female *Lebistes* have not been noted to display any interest in sex activity, as is common in forms that require cooperation of the sexes to insure reproduction.

In no case was there any error noted in locating the genital region by a courting male. The gonopodium was always accurately thrust toward the region of the genital pore, including that of the projected shadow. The problem, in this species at least, shifts from mate recognition to recognition of the genital region.

46. EFFECTS UPON YOUNG MALE FERRETS (*PUTORIUS VULGARIS*) OF A CONSTANT DAYLENGTH OF EIGHT AND A HALF HOURS, AND OF SIX HOURS OF ILLUMINATION AFTER DARK BETWEEN NOVEMBER AND JUNE. T. Hume Bissonnette, Trinity College and Marine Biological Laboratory.

From November 10th, three immature male ferrets were given constant 8½-hour days till killed at 106, 125, and 149 days for histological studies of gonads and epididymides; three others were given whole days plus 6 hours of electric light each night till killed at 106, 210, and 211 days (June 9th), for similar studies. Mating reactions and potency were tested at intervals from January 13th onward. Onset of sexual activity was delayed considerably in two 'short day' ferrets, as compared with normals, only slightly in the third. It was hastened in two 'long day' animals, but was late in the third. In both groups, interstitial cells came into activity more quickly than germ cells, and, in two 'long day' animals, remained active longer after testis regression set in. Epididymal changes were more closely correlated with interstitial than with germ cell changes. In 'long day' animals, anoestrus set in before June 8th (when ferrets of normal light cycles are at complete oestrus), in spite of increasing time and intensity of daily light. So that, while increasing light induces or hastens oestrus in such young males, anoestrus sets in after a time even in spite of it. Their anoestrus is related either to reactions within the animals, unrelated to light, or to increase of lighting above the optimum, or to both. It may be possible, however, that shortening days after June 21st hasten it in nature.

47. REVERSAL OF THE SEXUAL CYCLE IN MALE FERRETS BY INCREASING PERIODS OF EXPOSURE TO LIGHT BETWEEN OCTOBER 2ND AND MARCH 30TH. T. Hume Bissonnette, Trinity College and Marine Biological Laboratory.

Mature male ferrets were given increasing electric light following normal days from October to March inclusive, and killed at 15 to 179 days, with reference controls. Sexual cycles were reversed for gonads, hypophyses, accessory sex organs studied, and libido. Spermatogenesis was complete before November 7th; but anoestrus ensued before March 30th, in spite of increasing 'lighting.' Accessory organs and libido were more closely correlated with interstitials than with germ cells.

'Pseudo-seminal vesicles' and their photoperiodism are described.

Two hormones from the anterior hypophysis were indicated (one activating the germ cells, the other the interstitials), differentially stimulated by 'lighting,' so that interstitials came on more quickly and were maintained in activity longer than germ cells. The latter seemed to be the more susceptible to regression, either under falling light or on desensitization to the hormones, which occurred in spite of the increasing lighting. This failed to maintain oestrus indefinitely probably because of internal rather than environmental changes. Other possibilities are discussed.

An inherent sexual rhythm in ferrets, independent of light stimulation and due to accumulation of hypophyseal hormones followed by desensitization to them, modified by light cycles in nature, is suggested. Animal species probably differ greatly in the relation of their sexual cycles to light cycles, as do plants. In some animals, sexual photoperiodism seems to be slight or absent.

48. THE RELATION OF TEMPERATURE TO RESPIRATORY REGULATION IN THE LEECH (*HIRUDO MEDICINALIS*). Verlus F. Lindeman, Syracuse University.

In approximately fifty experiments involving five different temperatures, an attempt has been made to determine to what extent variations in temperature influence the ability of the leech (*Hirudo medicinalis*) to regulate oxygen consumption at various oxygen tensions. Employing the Winkler method, determinations of dissolved oxygen were made from time to time as the animals were allowed to lower the oxygen concentration by their own respiration. The range to which oxygen consumption is independent of oxygen tension has been found to be considerably influenced by temperature, i.e., low temperatures being more conducive to a greater range of respiratory regulation than high temperatures. The oxygen tension below which oxygen consumption became a function of oxygen concentration was found to be approximately 0.45, 0.85, 1.19, 1.31, 1.34 cc. oxygen per liter at the following temperatures, respectively: 10°, 17°, 24°, 30°, 34° C.

49. THE RESPIRATORY QUOTIENT OF DEVELOPING GRASSHOPPER EMBRYOS (*MELANOPLUS DIFFERENTIALIS*). Edgar John Boell, State University of Iowa. (Introduced by J. H. Bodine.)

The respiratory quotient of grasshopper embryos throughout their entire development has been determined by means of the Warburg technique.

During the first 5 days of the embryonic life history the R.Q. lies at or close to unity; from the fifth to the tenth day it is gradually reduced from 0.90 to 0.75, while during the next 8 to 10 days of development the R.Q. closely approximates 0.75. At this time the embryo enters into a long period of developmental block or diapause during which the R.Q. drops to and remains at 0.70.

The diapause is overcome after a variable length of time, or it may be broken artificially by subjecting the eggs to low temperature (0° C.). As a consequence developmental processes again take place, and hatching occurs in from 17 to 25 days at 25° C. During this period of development, as in diapause, the R.Q. remains at 0.70. A slight increase over this value, however, usually occurs during the 2 or 3 days immediately before hatching.

From these facts it is apparent that the energy for the early stages of development is derived largely from the combustion of carbohydrate and protein. Fat serves to maintain the embryo during diapause and as the energy source for postdiapause development.

50. METHYLENE BLUE CATALYSIS OF OXIDATIONS IN THE EMBRYONIC CELLS OF *MELANOPLUS DIFFERENTIALIS* (ORTHOPTERA). J. H. Bodine and E. J. Boell, State University of Iowa.

Developing grasshopper embryos have been freed from their protecting egg membranes and cultured in isotonic balanced salt solution (0.9 per cent NaCl, 0.02 per cent KCl, 0.02 per cent CaCl_2). With only moderate precaution such embryos may be kept in a perfectly normal state for 24 hours or longer.

The oxygen consumption of individual embryos has been measured by means of a highly sensitive micro-differential manometer. The respiratory rate of an embryo so isolated is slightly higher than that of one around which the egg

membranes are still intact, but remains constant for 12 hours or more. Beyond this time due to the multiplication of bacteria a slow, but gradual, increase in respiratory rate occurs.

The addition of 0.067 per cent methylene blue to the medium surrounding the embryo practically doubles the respiratory rate. After approximately 2 hours the respiratory rate drops from the initially high value to about 135 to 150 per cent of the normal.

51. STUDIES OF THE ELECTROMOTIVE FORCE OF BIOLOGICAL SYSTEMS: IV. THE EFFECT OF CARBON MONOXIDE ON THE E. M. F. OF FROG SKIN. A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)

The effect of various concentrations of carbon monoxide upon the electromotive force of frog skin has been studied by the use of an apparatus through which Ringer's solution flowed continuously. The E.M.F. determinations were made potentiometrically.

The carbon monoxide was prepared by heating formic acid with sulphuric acid, was collected in a gasometer and mixed with the desired amount of oxygen. Analyses of the gas mixtures were made by the Haldane method.

In all cases Ringer's solution saturated with the CO/O₂ mixtures (80-20, 90-10, 95-5, 97-3, 100-0) was prepared as follows: the Ringer solution was heated until it had reached the boiling point so as to free it of oxygen. As it cooled the gas mixture was slowly bubbled through; at intervals the Ringer was vigorously shaken in order to facilitate saturation with the desired gas mixture. In all experiments the CO/O₂ saturated Ringer was in contact with the skin for a period of 1 hour.

It has been observed that carbon monoxide produces a reversible depression of the E. M. F. of frog skin, the degree of which depends upon the concentration used. That these results are not due to decreased oxygen tension are supported by experiments with various nitrogen-oxygen mixtures.

Increased diminution of E.M.F. when carbon monoxide treated skins were subjected to darkness was not observed.

Restoration of skins to aerated Ringer solution resulted in complete recovery of potential in practically all cases.

52. ANTAGONISM OF METHYLENE BLUE AND KCN FOR EMF AND RESPIRATION OF FROG'S SKIN. Gordon Marsh, State University of Iowa. (Introduced by J. H. Bodine.)

The reversible depression by KCN of the EMF of frog's skin (bathed on both sides by Ringer's solution) can be counteracted by the addition of methylene blue. Concentrations of methylene blue of the order of 0.001M completely antagonize KCN in concentrations of 0.00004M or less; at the lower concentrations of cyanide methylene blue causes an increase in potential. Above 0.00005M KCN the antagonism is so slight as to be negligible, disappearing completely above 0.0001M KCN. The critical concentrations of methylene blue and cyanide at which the respective effects balance are approximately those found by Lund for antagonism between cyanide and oxygen. Methylene blue likewise inhibits the depression of oxidation rate of frog's skin by cyanide.

53. THE EFFECT OF AGGREGATION ON OXYGEN CONSUMPTION IN SNAKES. H. J. Clausen, American Museum of Natural History.

The oxygen consumption of a series of snakes (*Storeria dekayi*) were tested, using a slight modification of the Haldane-Henderson gas analysis apparatus. Tests were carried out at temperatures from 10°C. to 30°C. for aggregated and isolated individuals. Hourly tests were made over a 6-hour period for each individual series. Seasonal variations were also recorded.

No sex differences in oxygen consumption per unit weight are evident except during the breeding season. At this time both sexes have a higher rate in either the isolated or aggregated condition. Intersexual bunching increases the rate additionally at this time. Gestating females show a lowering in oxygen consumption per unit weight prior to parturition. This low rate is followed by a sharp increase immediately following parturition. A gradual return to the normal average is then noted.

Individual snakes, when in the aggregated condition, consume less oxygen than when isolated. Temperature changes effect both conditions at proportionate rates. Aggregation reduces the tendency toward activity. In correlation with this, the oxygen consumption of single snakes when placed in containers with infiltrated individuals is reduced. The oxygen consumed per unit weight under these circumstances is still higher than in an aggregate of live snakes. Therefore, activity and surface exposure are not the only factors modifying oxygen consumption in isolated or grouped snakes.

These experiments show that aggregation influences oxygen consumption and furthermore supports the work previously reported (Noble and Clausen, '33), indicating that aggregation results in a better metabolic balance.

ENDOCRINOLOGY

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54. PROLACTIN INDUCES BROODINESS IN FOWL. Oscar Riddle, Robert W. Bates and Ernest L. Lahr, Carnegie Institution of Washington. (Lantern; 15 min.)

Prolactin has been identified as the hormone specifically concerned in the induction of broody behavior—including an aspect of maternal behavior—in fowl. A full expression of broodiness was obtained only in actively laying hens which are genetically capable of broodiness, and with dosage sufficient to depress the ovary (twenty-nine tests). Partial broodiness, as expressed by clucking without nesting, is induced by prolactin in most laying and non-laying hens of a non-broody race, and in non-laying hens of so-called broody races (thirty tests). This partial response was also obtained in two mature roosters belonging to a race within which the hens may normally become broody.

Follicle-stimulating, thyreotropic, prolan and mare serum preparations are ineffective (fifty-four tests); effectiveness of a 'luteinizing' pituitary principle is excluded. Prolactin heated to 100° for 1 hour to destroy any growth principle is effective. Female sex hormone and corpus luteum hormone are ineffective (four tests).

This fourth response to prolactin is apparently closely associated with its previously known repressive effect upon the active mature gonads of birds, and with the crop gland response in pigeons. Apparently all of these three responses in birds, like the known response (lactation) in mammals, are intimately associated with the care and feeding of the very young. This demonstration of the role of a hormone in the initiation and maintenance of a behavior-complex has an unexplored importance in the general problem of behavior.

55. THE EFFECTS OF DAILY INJECTIONS OF HEBIN ON THE DEVELOPMENT OF SEXUAL CHARACTERS IN FEMALE LEGHORN CHICKS. L. V. Domm, The University of Chicago. (Lantern; 15 min.)

The development of masculine head furnishings in Hebin-treated female Leghorn chicks is particularly significant. Daily injections of ten rat units beginning on second or fourth day caused conspicuous growth of head furnishings. The effect, which could frequently be noticed within 72 hours, was almost invariably definitely apparent by 6 to 7 days. Head furnishings became similar to those of treated males.

Postmortem revealed hypertrophied ovaries and oviducts. Ovaries were four to five, oviducts twenty to thirty-five times heavier than controls.

In comparing sections of treated and control ovaries one notices a conspicuous stratification in the former. Follicles in treated cases were quite noticeably confined to the periphery and in some formed a narrow layer of tissue clearly differentiated from the central greatly hypertrophied medulla. These early treated cases therefore seem to differ from those treated at a later age in that they reveal definite medullary hypertrophy with less evident cortical hypertrophy whereas in the latter both components of the ovary revealed hypertrophy though medullary hypertrophy was never so clearly evident.

Our results on ovariectomy led us to suppose that the male hormone causing development of head furnishings here was produced by the rudimentary right gonad. However, results on treated sinistrally ovariectomized pullets necessitate another interpretation since these disclosed no positive growth of head furnishings. These results indicate that, at least for ages considered, the rudimentary gonad supplies little, if any, of the male hormone responsible for masculinization of head furnishings and that its chief source must be the medulla of the ovary.

56. EFFECTS OF THYROXIN ON PLUMAGE OF THE ENGLISH SPARROW, *PASSER DOMESTICUS* (LINNAEUS). Dorothea Starbuck Miller, State University of Iowa. (Introduced by Emil Witschi.) (Lantern; 5 min.)

The effects of experimental hyperthyroidism on the regenerating plumage of normal and castrated male and female sparrows were studied. Feathers were plucked from selected areas which show sexually dimorphic color patterns. Three to 5 days after depluming, a water solution of crystalline thyroxin was injected into the breast muscle. Striking modifications in pigmentation occur in the chestnut brown contour feathers and the black breast feathers of the male. The melanin granules become scarce, making the feathers appear buffy grey. The regenerating feathers of the light grey belly region are darker than normal. The threshold of reaction to injected crystalline thyroxin is 4 mg. per kilogram body weight. Thyroxin fed in tablet form is much less effective.

Normal and castrated males and females are affected by thyroxin injection. Capons exhibit more severe general effects, but the plumage color is modified to a smaller degree. In the male, feathers which regenerate in the lesser wing covert and the breast and belly regions resemble the female more than the normal male type, although the details of the patterns are not identical. The female feathers also show pigmentary changes after thyroxin administration. It would be premature to conclude that the thyroid normally is involved in the control of sexual dimorphism in feather pattern.

Hyperthyroidism accelerates the seasonal sex cycle of the male sparrow, as indicated by the bill color, both at the beginning and at the end of the breeding season.

57. THE OESTROUS-PRODUCING PRINCIPLE IN THE URINE OF GUINEA PIGS WITH X-IRRADIATED OVARIES. Ida T. Genther, University of Cincinnati. (Lantern; 15 min.)

The functioning of ovaries of guinea pigs, following x-irradiation with a minimum sterilization dose, is being studied further by testing the oestrous-producing principle of the urine. The urine samples were extracted repeatedly with ether, the residues were taken up in olive oil, and injected quantitatively into castrated rats. Normal controls, in oestrus, reacted uniformly; the quantity of extract required to produce oestrus in rats was constant. The urine of irradiated animals, in prolonged oestrus with continued cornification (and 'interstitial gland' in the ovaries), did not maintain the same level of hormone throughout the oestrous period; the amount fluctuated, from as much or more than in the controls, to none. The greatest amounts seem to be associated with the presence of a large, healthy follicle in the ovary. The urine of other irradiated animals, with prolonged, indefinite oestrous openings without cornification (ovaries with few follicles, and degeneration of the large ones instead of ovulation), likewise fluctuated in hormone content, but most of the extracts were negative, and the maximum amounts were less potent than in normal controls; this maximum was probably associated with the presence of a large follicle.

These results are preliminary. More complete data will be available when the material is presented.

58. FACTORS WHICH GOVERN OVARIAN DEVELOPMENT. H. L. Fevold, F. L. Hisaw and R. O. Greep, University of Wisconsin. (Introduced by W. S. Marshall.) (Lantern; 15 min.)

Follicle stimulating and luteinizing hormones (F.S.H. and L.H.) when injected simultaneously in immature rats, produce follicular and lutein development and the ovaries increase in weight much more than can be expected from an additive effect when they are injected separately. This additional increase is what we term 'augmentation.' L. H. injections, followed by F. S. H. also produces this increase but luteinization does not take place. F.S.H. followed by L.H. does not result in augmentation but the ovaries become luteinized.

Augmentation can likewise be accomplished by stimulating the animals' own pituitary to produce the L.H. First, if the cervixes of immature rats are mechanically stimulated followed by F.S.H. injection, augmentation takes place

without luteinization, similar to L.H. injections followed by F.S.H. Second, if the rats are treated with oestrin previous to F.S.H., augmentation occurs with luteinization similar to simultaneous injections of F.S.H. and L.H. The difference in the results obtained by cervical stimulation and by oestrin treatment seems to be that the first causes an elimination of L.H. already in the pituitary while the second causes an active secretion and elimination of the hormone. Augmentation of the reaction to F.S.H. does not follow cervical stimulation or oestrin treatment of hypophysectomized rats.

The changes which take place in the maturing ovary, are the results of the combined actions of two gonadotropic hormones, F.S.H. and L.H. The physiological action of either F.S.H. or L.H. on the ovary is influenced by the previous or simultaneous action of the other.

59. THE FOLLICULAR APPARATUS OF THE OVARY OF THE IMMATURE RAT AND SOME OF THE FACTORS WHICH INFLUENCE IT. C. E. Lane and F. L. Hisaw, University of Wisconsin. (Introduced by George Warner.) (Lantern; 15 min.)

The total follicles and the percentage of this total which was vesicular have been studied in the ovaries of a series of normal rats between the ages of 15 and 66 days.

Administration of purified F.S.H. resulted in an increase in the total number of follicles of 68 per cent above the normal controls of the same age. There was no effect on the percentage of this total which was vesicular.

Purified L.H., on the other hand, caused no change in the total follicle count, but nearly doubled the percentage of vesicular follicles.

Administration of oestrin apparently stimulated the formation in the hypophysis, of L.H. This is reflected in the ovaries of the injected animals, and can also be detected by implantation of the pituitaries of injected animals into normal 22-day-old recipients.

Corporin was without demonstrable effect on the hypophysis but exerted an ovarian effect similar to that resulting from administration of F.S.H.

Mechanical stimulation of the cervix of 22-day-old rats produced ovarian changes in 5 days, which were similar to those produced by the administration of purified L.H.

In a preliminary study of the adult oestrous cycle, pituitaries were taken from adult cyclic females at various stages of the cycle and implanted into normal 22-day-old recipients. Pituitaries from animals in the dioestrus showed most F.S.H. activity and least L.H. activity. In oestrus the glands contained most L.H. and least F.S.H.

60. A PHYSIOLOGICAL EXPLANATION OF THE OESTROUS CYCLE OF THE RAT. F. L. Hisaw, H. L. Fevold, M. A. Foster and A. A. Hellbaum, University of Wisconsin. (Lantern; 15 min.)

Beginning with ovulation and lutein development the A.P. gradually increases in F.S.H. during the dioestrus similar to that following castration. This is associated with follicular development and increasing oestrin secretion. With the rapid increase of oestrin during proestrus F.S.H. secretion is decreased and secretion of L.H. stimulated as a result of oestrin action on the A.P.

Preovulatory follicular swelling and ovulation are due to an 'augmentation' action of F.S.H. plus L.H. The F.S.H. is decreasing and L.H. is increasing at this time and ovulation occurs at the optimum quantitative balance of the two hormones. Ovulation can be induced in F.S.H. treated rats by the injection of oestrin. Cervical stimulation (nervous) also enhances L.H. secretion.

The corpus luteum hormone corporin, present during the dioestrus, does not seem to act, at least directly, on the A.P. but there is considerable evidence that it does decrease the inhibitory effects of oestrin, on the A.P. thus prolonging the cycle and facilitating the increase of F.S.H. The F.S.H. alone produces follicles only to the point preceding preovulatory swelling and on the physiological involution of the corpora lutea, associated with the increase of oestrin, L.H. secretion rises, ovulation occurs and the cycle is repeated.

61. SEXUAL PERIODICITY IN THE MALE GROUND SQUIRREL (*CITELLUS TRIDECIMLINEATUS*). L. J. Wells, The University of Chicago. (Introduced by Carl R. Moore.) (Lantern; 15 min.) (Also by demonstration.)

More than 500 males have been studied. Both normal and experimental animals were autopsied, during each month of the year. Testis, epididymis, vas deferens, seminal vesicle, prostate gland, bulbar gland and Cowper's gland from each animal were studied, both grossly and histologically.

Breeding capacity is attained in April and persists for about 6 weeks. All reproductive structures regress and remain in practically complete quiescence throughout late summer and autumn. Activity within genital organs is renewed during hibernation and gradually increases.

Castration apparently reduced accessories to a level only slightly lower than that found following normal involution. Unilateral castration resulted in compensatory hypertrophy of the remaining testis.

Injected male hormone produced functional accessories, in both normal and gonadectomized males, at any season.

Gonadotropic substances (pregnancy urine and extracts; pituitary and extracts) stimulated the testis and all accessories (indirectly), at any period, but failed to stimulate accessory organs of castrates. Spermatozoon formation was induced, during the season of low sexual activity, by addition of untreated urine from pregnant women, Antuitrin S and fresh rat-pituitary implants.

Bio-assays, using the immature female rat as test animal, showed that the anterior pituitary of breeding males had great sex stimulating potency, while that of animals with abdominal testes had very little or none.

The annual sexual cycle in the male of this species is probably controlled by periodicity within the anterior pituitary gland. Experimental manipulation of temperature, light and diet have failed (so far) to reveal the environmental factors that regulate the anterior pituitary.

62. EFFECT OF THYROIDECTOMY ON TESTICULAR FUNCTION. George K. Smelser, Columbia University. (Lantern; 15 min.)

In an effort to clarify the relation of the thyroid to testicular function the male reproductive system has been studied in thyroidectomized rats and normal littermate controls from eighteen litters. Completeness of thyroid removal was

determined at autopsy by carefully examining the operated site with a binocular microscope, by sectioning suspected tissues, and by sectioning serially the neck regions in about half the cases. Thyroidectomies were performed on 4- to 6-month-old rats autopsied 40 to 200 days later. Each animal was unilaterally castrated just preceding or immediately after thyroidectomy; the weights of the testis, epididymis, and number of sperm in the epididymis served as controls with which data obtained at autopsy were compared.

The data show smaller accessory reproductive organs and fewer sperm produced in the thyroidectomized animals than in the controls. These findings are difficult to harmonize with the discovery that the pituitaries of these animals contain 'signet-ring' cells, (Severinghaus, Smelser and Clark). They appear identical in structure to castration cells associated with increased pituitary potency. Furthermore, Smith and Engle, and Schockaert report that gonads of thyroidectomized animals are particularly responsive to gonadotropic hormones.

Potency of the pituitaries from a series of these rats was determined by implanting them into immature mice. Only half of each anterior pituitary was implanted, the other reserved for cytological study. No evidence of any marked change in the potency of the pituitaries was found, although sections of the control half showed definite castration cells.

63. THE EFFECTS OF HYPOPHYSECTOMY AND THYROIDECTOMY ON THE SHEDDING PROCESS OF SNAKES. Walter H. Schaefer, University of Wisconsin. (Introduced by M. F. Guyer.) (Lantern; 7 min.)

Removal of either the hypophysis or the thyroid gland in a total of 120 snakes accelerated the development of new epidermal generations. Molting cycles occurred less frequently at a temperature of 70°F. than at 90°F. Elevation of temperature, therefore, acted as an independent accelerating factor in the process. Administration of hypophyseal extracts or thyroid feeding inhibited the excessive shedding rate of hypophysectomized animals.

Six control normal snakes kept at a temperature of 90°F. shed at an average rate of once every 30 days. Thyroid feeding under the same conditions inhibited shedding entirely for a period of 120 days; while the cells of the skin increased in number, differentiation into the customary layers was entirely inhibited.

By demonstration

64. SEXUAL PERIODICITY IN THE MALE GROUND SQUIRREL (*CITELLUS TRIDECIMLINEATUS*). L. J. Wells, The University of Chicago.

See abstract no. 61.

65. EFFECT OF THYROID AND THYROXIN INJECTIONS ON THE TESTIS AND ACCESSORY REPRODUCTIVE ORGANS OF THE RAT. George K. Smelser, Columbia University.

No abstract received.

66. THE CYTOLOGICAL CHANGES IN THE ANTERIOR PITUITARY OF THE HYPO- AND HYPERTHYROID RATS. Aura E. Severinghaus and George K. Smelser, Columbia University.

No abstract received.

By title

67. THE EFFECT OF THYROXIN INJECTIONS UPON THE FEATHER OF THE GUINEA FOWL. Mary Hardesty, Tulane University.

Ten guinea fowls were injected with thyroxin, in 2 mg. to 6 mg. doses. Doses of 4 mg. and above produced general molting with regenerating feathers appearing sooner than normal. Thyroxin, even in lower doses, abruptly stimulates the germ lying quiescent in the follicle.

Comparison of feathers treated with 4 mg. of thyroxin with their predecessors and successors grown from the same follicles shows that the thyroxin feathers break more easily, that they are shorter, that they carry fewer barbs, and that they require a shorter time to reach maturity. Such feathers show modifications over at least two pattern periods. The contour of the feathers is concave due to shorter barbs in the affected region. The spots of the first pattern period are smaller and lie closer to the transverse row above than normal; in the second pattern period the spots are larger and lie farther from the row above. Corresponding differences in the spacing of barbs on the rachis together with increases in the growth rate of barbs account for these pattern changes. The differences in barb spacing are in turn due to a more rapid deposition of barbs at the ventral side of the collar, and to two complementary changes in the growth rate of the rachis.

68. THE EFFECT OF POSTPUBERTAL CASTRATION ON THE PLUMAGE AND HEAD FURNISHINGS IN THE GUINEA FOWL. Mary Hardesty, Tulane University.

Three sexually mature male guineas were castrated and one mature female ovariectomized. At the time of the operations the wattles were measured and feathers plucked from marked follicles in the breast, saddle and neck. Feathers grown subsequently from the same follicles showed no modifications in size, shape, texture, color, or in the configuration of the pattern. Moreover, there was no change in the dimensions of the wattles of either sex, nor was their turgidity or surface texture in any way changed. Autopsy revealed no regenerated gonad tissue.

Kříženecký and Kamenicek ('32) have reported a 25 per cent reduction in the wattles of guineas castrated at 5 months. It remains to be seen what effect castration at an earlier age, e.g. 6 weeks, might have on the wattles and the bony crest. The evidence indicates that the crest and the plumage of the guinea are independent of gonad control. It is possible that the wattles can be considered as true secondary sex characters, but after maturity the sex hormones do not influence even these structures.

69. FEATHER GERM TISSUE CULTIVATED IN VITRO. Mary Hardesty, Tulane University.

Feather germ tissue from the adult guinea fowl was cultured by a method only slightly modified from the standard method used by Bloom and his associates. Excellent outgrowths were obtained in 80 per cent of the explants. This technique is suggested as an approach to the study of the mechanisms by which integumentary structures respond to the sex hormones and to thyroxin. The writer, however, was unable to obtain pigment differentiation in the cultures.

70. BEHAVIORISTIC VERSUS ANATOMICAL SIGNS IN THE IDENTIFICATION OF OESTRUS IN THE GUINEA PIG. William C. Young, Hugh I. Myers and Edward W. Dempsey, Brown University.

Prooestrous behavior in the female guinea pig involves the pursuit of other animals either male or female, and successful attempts to mount them which are accompanied by all the movements of copulation. Oestrous behavior which begins usually about 1 to 3 hours before prooestrous behavior has ended appears suddenly, is very intense at first and diminishes gradually as the end of the period is approached. Its most important diagnostic character is the copulatory reflex or lordosis. This consists in the assumption of a stable posture, a straightening and arching of the back which is accompanied by the elevation of the entire pelvic region and the emission of a single purring sound lasting very often several seconds. The response can be elicited repeatedly by simply stroking the animal on the back or by the male.

Each behavior, but especially the latter, is definite, easily identified and surpasses by far the more commonly used anatomical signs such as the open vaginal orifice, the vaginal smear picture, and the appearance of the external genitalia in determining the occurrence of oestrus, its length and the time of ovulation. The latter occurs within $1\frac{1}{2}$ hours of the end of oestrus which can be ascertained by simply fingering the animal as indicated above until the copulatory reflex is no longer given. In animals in which oestrus has been short ovulation usually occurs soon after its end, in animals in which oestrus has been long ovulation usually occurs soon before its end.

71. HORMONE PRODUCTION OF RAT TESTICULAR FRAGMENTS. Ira B. Hansen, Union College.

An estimation of the male hormone production of portions of rat testis was made following partial castration. One testis was removed completely, and the remaining was cut transversely, leaving the upper end of the testis attached to its blood supply. The size of the remaining piece of testis was varied from animal to animal so that the fragments at the time of operation consisted of pieces of very small size and others equal to two-thirds of a single testis. Three weeks after operation the animals were killed and the seminal vesicles, prostates and testicular fragments recovered. The testicular fragments were weighed and serially sectioned. All fragments were cryptorchid and their histology was of that type. The prostate and seminal vesicles were sectioned and the estimation of the hormone produced based upon their cytology.

Testicular fragments under 0.05 gm. in weight produced no measurable hormone. A piece 0.07 gm., however, produced good light areas in the cells of the prostate and resulted in a high epithelium with granules in the seminal vesicles. This represents about 3.1 per cent of the average weight of both testes in the rats used. This indicates that more testis is necessary to maintain normal accessories in the rat than reported for the guinea pig and mouse.

72. THE INFLUENCE OF SEVERAL ENDOCRINES ON HAIR GROWTH IN THE DORSUM OF THE WHITE RAT. Earl O. Butcher, Hamilton College.

The growth of the hair of the second cycle, which begins about the thirty-fourth day in the normal rat, is influenced by various endocrines in the following ways when the experimental procedure is begun on the twenty-third day. Hair growth is retarded 4 or 5 days and is poorer in quality upon thyroidectomy. Thymus-ectomy produces no effect. Administration of 3 cc. of pregnancy urine daily causes a retardation of 4 to 5 days in the female and less effect in the male. Twenty-five one-hundredths cubic centimeter of Antuitrin G daily produces no change. The effects of 12 R.U. of Theelin daily are variable and an acceleration occurs in 15 per cent of the cases. Four-tenths cubic centimeter of 1:5000 adrenalin chloride daily retards the hair growth from 2 to 3 days. The hair appears usually from 2 to 4 days before that in litter mates upon bilateral adrenalectomy.

Other than the thyroid, hormones in pregnancy urine and alteration in the adrenals produced the most constant effects. The acceleration in adrenalectomy is very interesting since there is only a small gain in body weight. The relation of the adrenals and the retardation by adrenalin are being further investigated.

73. BREPHOPLASTIC SUBCUTANEOUS GRAFT OF THE THYROID IN THE RAT. Raoul M. May, Institut Pasteur.

A brephoplastic graft is the functional and lasting transplantation of tissues from embryonic and newborn animals into young or adult ones.

The thyroid and parathyroid from a newborn rat, implanted under the skin of a young rat which is thyroidectomized a few days later, become vascularized, grow, and differentiate histologically as they would have done in situ. Weighings made every month during 7 months showed that the thyroidectomized rats bearing a graft developed similarly to the unoperated controls, while the rats of the same sex and age which were merely thyroidectomized had a very incomplete development or died. The grafted tissues thus assume the functions of the similar tissues which are missing in the graft bearer.

74. AN EXPERIMENTAL STUDY OF OVARIAN IRRADIATION AND TRANSPLANTATION IN THE RAT. James Mandel, New York University. (Introduced by H. O. Haterius.)

Ovarian irradiation of immature albino rats, 7 to 10 days of age, was followed by precocious vaginal opening and the appearance of oestral changes at approximately 22 days of age, at which time the ovaries were characterized by huge follicles with enormous antra.

When x-ray dosages of 540 'r' units were applied to the ovarian region the ovaries at 6 weeks' post-irradiation possessed many large follicles and the genitalia were normal in appearance. Such ovaries when transplanted into previously spayed immature females induced premature vaginal opening and oestrus. On the other hand, when dosages varying from 830 to 1240 'r' units were employed the ovaries at 6 weeks' post-irradiation were made up mainly of proliferative cords and interstitial tissue together with a few large follicles. The sex acces-

sories in this instance were castrate in appearance. Such ovaries when transplanted into previously spayed immature females were incapable of influencing the time of sexual maturity.

The data obtained appear to lend support to the view that, in the rat at least, the follicular apparatus exercises the dual endocrine function of maintaining the sex accessories and of 'stimulating' the anterior lobe of the hypophysis.

75. PRECOCIOUS MATURITY IN IMMATURE FEMALE GUINEA PIGS FOLLOWING TREATMENT WITH PITUITARY EXTRACTS. Roy O. Greep, University of Wisconsin. (Introduced by Frederick L. Hisaw.)

Precocious oestrus was produced in immature female guinea pigs treated with extracts of the anterior pituitary. The quantity of material administered and its relative purity for follicular stimulation were found to be important factors in obtaining the complete oestrous response. Low doses (0.5 to 2 R.U.) of unfractionated extracts and somewhat greater doses of highly purified follicle stimulating preparations were found to be the most effective. The vaginae of these animals opened 5 to 8 days after beginning the treatment. The effect upon the size and structure of the gonads was noted. Increase in ovarian weight of as much as 1000 per cent was obtained. The range of effective dosages for producing ovarian enlargement in the guinea pig is peculiar in being restricted to rather narrow limits. Attempts to produce ovaries of greater size by raising the dosage has invariably demonstrated that when the optimal dosage for a maximal response is exceeded the amount of ovarian enlargement is markedly diminished. The oestrous response in the uterus and vagina is dependent upon the induction of primarily follicular development in the ovary. The presence of appreciable amounts of lutein or pseudo-lutein tissue precludes hypertrophy of the genital tract and inhibits opening of the vagina. Extracts of pregnant mare serum and the urine of pregnant women also produce the maturity response.

EMBRYOLOGY

Read

76. LIFE HISTORY STUDIES ON SOME PACIFIC ANNELIDS. John E. Guberlet, University of Washington. (15 min.)

The eggs of *Nereis agassizi* and *N. procera* were fertilized in the laboratory and the resulting larvae were reared to sexual maturity. In the first named species the complete life cycle was completed during each of 2 consecutive years and during the third attempt the larvae were carried for more than a year but due to deficient food sexual maturity was not reached. The problem of a proper diet is of the utmost importance in rearing early annelid larvae. Diatoms, consisting of species of *Nitzschia* and *Navicula*, were found to be of suitable size and were readily consumed by the larvae. This diet was supplemented later by adding kelp, particularly *Nereocystis* and *Ulva*.

Observations were made on the spawning habits of *Nereis*, *Glycera* and *Arenicola*. The well-known spawning periods corresponding to the lunar cycles are noted. Other possible factors which may influence the spawning acts of various marine polychaetes are discussed. During observations in Puget Sound, covering

a period of several years, it has been observed that there are apparently several factors, such as tides, light, calmness of the water, time of day and temperature which may be significant. Unquestionably, no single factor is entirely responsible for the performance of the act.

77. CHANGES IN RADIOSENSITIVITY OF GRASSHOPPER EMBRYOS DURING DEVELOPMENT.
Titus C. Evans, State University of Iowa. (Introduced by J. H. Bodine.)
(Lantern; 7 min.)

Radiosensitivity was measured, 1) by the intensity of x-rays necessary to prevent hatching, 2) by the extent of development following a particular intensity, and, 3) by determining the intensity necessary to stop the development within 2 or 3 days. It was found that the undifferentiated and rapidly developing pre-diapause embryos are extremely susceptible and that the later stages are more resistant. Diapause or blocked embryos are more resistant. In general, developmental age is an important factor in radiosensitivity.

Embryos are more resistant if the diapause or block normally continues for a period following irradiation. Developing embryos are made more resistant if kept inactive, by low temperature, for a long period of time following irradiation. It seems, therefore, that resistance depends upon and is influenced by low physiological activity during and following irradiation.

78. THE EFFECT OF X-RAYS ON DIFFERENTIATION IN DROSOPHILA EGGS. P. S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)

The effect of x-rays on development in *Drosophila melanogaster* eggs has been studied both quantitatively and qualitatively. It was found that the quantity of radiation required to kill the organisms varied considerably during early development. During cleavage and blastulation, the organisms were relatively quite susceptible; but, about the onset of gastrulation their resistance increased several fold, dropping off somewhat shortly after the beginning of gastrulation.

During cleavage and blastulation mitosis is synchronous among the somatic cells and takes place at the rate of one cleavage every 10 to 12 minutes at room temperature. At the time of gastrulation, which is the beginning of differentiation, the mitotic activity is very greatly reduced and much localized—a remarkable example of physiological regulation of cellular activity.

Sections were prepared of organisms which had received lethal doses of radiation during cleavage and blastulation and then fixed at different times after the usual time of gastrulation. This was done to determine how quickly the mitotic activity was stopped after exposure to radiation. It was found that cell division had gone forward apparently unmolested, that more than the usual number of cells was present, and that little or no differentiation had taken place.

This suggests the presence of some kind of a physiological regulator in *Drosophila* eggs which determines the nature of the cellular activity and which is quite radiosensitive. The fact that the resistance increases suddenly at the time of gastrulation suggests that such a regulator, having exerted its influence in initiating differentiation, is no longer essential to the organism.

79. NORMAL DEVELOPMENT OF *DROSOPHILA MELANOGASTER* FOLLOWING REMOVAL OF PRE-BLASTODERMIC OOPLASM. Benjamin P. Sonnenblick, New York University. (Introduced by R. B. Howland.) (Lantern; opaque projection; 10 min.)

Individual females taken from isogenic stocks of *Drosophila melanogaster* and subjected to a certain experimental procedure involving, in sequence, isolation, mating, forced feeding and temporary starvation were found to lay eggs in rapid succession when placed on food in observation vials. As each egg was laid, its position and time of deposit were chartered on a timing sheet. The first eggs of each female were always discarded.

From 15-minute eggs globules of ooplasm were removed by puncture with glass microneedles. The punctured eggs were allowed, a) to develop as far as possible, or, b) to develop for definite periods of time, then fixed and serially sectioned.

Complete metamorphosis followed in 10.5 per cent of the cases. The external phenotypic characteristics of these flies were normal. Tests for sterility showed the operated flies to be fertile.

Cytologic investigations show that the ooplasm removed was practically yolk free; that the material removed consisted of the clearer superficial cortical ooplasm (Keimhautblastem) and the denser, more granular cytoplasm. The syncytial cleavage nuclei migrated into the injured region, proliferated and became part of the continuous blastodermic layer.

Lethalities are accounted for by, a) too drastic puncture, b) bacterial invasion, c) by disturbances in cytologic organization.

It is shown, therefore, that pre-blastodermic ooplasm may be removed from the egg of a dipteran, with a normal adult resulting.

80. THE DIFFERENTIATION OF THE SYMPATHETIC NERVOUS COMPONENTS OF THE CHICK SUPRARENAL IN CHORIO-ALLANTOIC GRAFTS. Alfred Brauer, University of Kentucky. (Lantern; 5 min.)

A graded series of grafts developed from isolations of the adrenal forming zone, made at from 88 to 96 hours incubation, were studied with reference to the following points: 1) the degree of nervous differentiation within the sympathetic-chromaffin masses prior to their penetration into the cortical body of the gland; 2) early innervation of the cortical nodules; 3) distribution and relative amount of sympathetic-chromaffin material adjacent to the developing gland prior to chromaffin cell differentiation.

The following observations have been recorded: 1) There is an early differentiation of sympathoblasts within the cell masses adjacent to the cortical bodies. The processes of these sympathoblasts ramify throughout the masses, eventually to bring into association all of the sympathetic-chromaffin cell groups. The nervous network attains its maximum development about the time that their penetration into the cortical bodies begins. 2) Among the cortical nodules of the least developed grafts differentiating sympathoblasts are found which eventually bring about an innervation of the nodules and establish an association between them and the sympathetic-chromaffin masses which lie in juxtaposition to the cortical bodies. 3) The sympathetic-chromaffin cells are quite uniformly, though scantily applied to the medial surface of the cortical bodies. They do

not form the definitely localized masses found in definite regions of glands developing in situ with the exception of a relatively poorly developed anterior cap of such cells. 4) The relative amount of sympathetic-chromaffin tissue to cortical tissue is from 35 per cent to 68 per cent less than that of glands developing in situ, as shown by the Rasmussen relative paper weight method.

81. EXPERIMENTS TO DETERMINE THE PRESENCE, LOCATION AND EFFECTS OF AN ORGANIZATION CENTER IN BRUCHID (COLEOPTERA) EGGS. Alfred Brauer and A. C. Taylor, University of Kentucky. (Lantern; 5 min.)

Hair-loop constriction and thermo-cautery experiments were performed on the eggs of the Coleopteran, *Bruchus quadrimaculatus* Fabr., to determine if possible the presence of an organization center, and if successful, its location, and its effects on development.

Hair-loop experiments have shown the following: constrictions made after 6½ hours' incubation at 28° C., e.g. during blastoderm formation, are strongly indicative of a strict mosaic development. Development on both sides of a constriction are more frequent in anterior than in posterior constrictions. Formation of a complete embryo may be found posterior to anterior constrictions prior to 6½ hours. In one case only was development found to occur in the anterior portion only, namely, in a complete constriction made after 6½ hours. In this case only head parts were formed. Early constrictions at no more than one-sixth the length of the egg from the posterior end prevent development of the anterior portion beyond an early blastoderm stage. When constrictions are made so early as to exclude cleavage cells from the posterior portion of the egg, those of the anterior portion form only a poorly developed blastoderm. Complete constriction of the anterior one-third prior to 1-hour incubation may result in a complete embryonic axis lying in other than the normal vertical plane. A protoplasmic isthmus between posterior and anterior egg portions, however narrow it may be, serves to conduct the organizing principle anteriorly.

Burning experiments, as yet incomplete in themselves have served as a positive check of the constriction experiments.

82. A RELATIONSHIP BETWEEN SIZE OF EGG AND A LETHAL MALPOSITION OF THE EMBRYO IN THE DOMESTIC FOWL. F. B. Hutt, University of Minnesota and Cornell University. (Lantern; 10 min.)

In weight, length and other dimensions, eggs which hatch do not differ significantly from those in which chicks die during the last 3 days of incubation but in the normal position for hatching. A malposition of the fully-formed but unhatched chick in which the head is under the left wing instead of the right one occurs in eggs of which the mean length and weight (when laid) are significantly greater than those of eggs which hatch or contain dead embryos not in malpositions. Eggs containing the head-left malposition exceeded the normals by 2.47 gm. and 0.78 mm. (maximum length) in White Leghorns, and by 1.85 gm. and 0.91 mm. in a composite sample drawn from heavier breeds.

This malposition of the embryo has its lowest incidence (1.5 per cent) in eggs weighing from 40 to 57 gm. when laid. Above the latter weight, its frequency increases steadily so that in eggs of 67 to 69 gm. it is over five times as common (7.9 per cent) as in those under 57 gm.

In view of this and other evidence the malposition is considered to arise when the ratio $\frac{\text{size of egg}}{\text{size of embryo}}$ exceeds an optimum figure. Since the malposition is apparently lethal in over 99 per cent of cases, and has been found in other species, it is considered to be a factor in causing the relative egg weight to decrease with increasing body size in birds.

83. THE ORIGIN OF MELANOBLASTS IN EARLY EMBRYONIC STAGES OF *TRITURUS TOROSUS* AS STUDIED BY THE DOPA TECHNIQUE. E. W. Blanchard and H. M. McCurdy, Bryn Mawr College and Biological Laboratory, Cold Spring Harbor. (Introduced by D. H. Tennent.) (Lantern; 10 min.)

Stages of *Triturus torosus* from the time of partial closure of the neural tube to the first appearance of dendritic melanophores, were studied by means of Laidlaw's modification of the Bloch Dopa technique, which has been shown to be specific for melanoblasts. Frozen and paraffin sections were used. In the first method whole embryos were hardened in 5 per cent formalin for 3 hours, frozen sections cut, and these sections treated from 3 to 8 hours at 37° C. with Dopa (2-4 dioxyphenylalanine) in phosphate buffers at pH 7.4. The tissues were rinsed in water, dehydrated, and mounted in balsam. Control tissues were treated with the buffer solution without Dopa. For serial sections, the whole embryos were hardened in formalin (5 to 10 per cent), treated in toto for 12 hours at room temperature (25°) with Dopa, rinsed in water, dehydrated, and embedded in paraffin. Ten μ serial sections were mounted and stained with Delafield's hematoxylin, Congo red and orange G. Photographs were made of the embryos at the time they were placed in formalin.

The results indicate that the melanoblasts of *Triturus torosus* are of ectodermal origin. In the very early stages Dopa-positive cells are present in the entire ectoderm. In the later stages Dopa-positive cells are found only in the region of the neural crests from which they migrate to the positions where they will become the definitive melanophores.

84. THE SOURCE OF PIGMENT CELLS IN AMPHIBIA. Graham P. DuShane, Yale University and State University of Iowa. (Introduced by Ross G. Harrison.) (Lantern; 10 min.)

Evidence from experiments involving removal, transplantation and explantation of the prospective ganglion crest cells of *Amblystoma* embryos proves that melanophores originate, not from connective tissue or epidermis, but from the ganglion crest. An embryo from which the neural folds (primordia of the neural crest) have been removed in the trunk region develops into a larva, normal except for the complete lack of pigment cells and fin fold in the region of extirpation. Prospective ganglion crest cells always give rise to pigment cells when explanted or transplanted to the same of another species. Flank ectoderm and mesoderm do not give rise to melanophores under the same conditions. Heteroplastic transplantations of ectoderm from *Amblystoma punctatum* to the flank of the white axolotl induces pigment formation in host (axolotl) cells which do not normally become pigmented. There is thus a definite inter-relationship between these induced melanophores and the overlying epidermis

which suggests that the epidermis supplies the induced melanophores with some substance necessary for pigment formation. This substance may be 'Dopa' or 'Dopa oxidase.'

85. MUTUAL SIZE REGULATION BETWEEN EYEBALL AND LENS IN AMBLYSTOMA.
W. W. Ballard, Dartmouth College. (Introduced by W. B. Unger.) (Lantern; 15 min.)

Heteroplastic combinations of eyeball and lens were made by grafting parts of the eye between embryos of *Amblystoma tigrinum* and *punctatum*, and measurements were made during their growth. Harrison's ('29) observations on the size-regulatory interaction of eyeball and lens were confirmed and extended. Growth of the smaller, slow-growing *punctatum* structures in these combinations is accelerated, growth of the more active *tigrinum* parts retarded, so that the proportions of the combination eye are not as grotesque as they would otherwise have been, although normal proportions are not quite attained. The regulatory interaction concerns only the retina and the lens; the mesodermal coats of the eye and the cornea have no specific control over eye size. Regulation following early embryonic operations is of greater extent than that following late embryonic operations, and is affected in some degree by the level of nutrition, as are the relative proportions of the normal eye.

86. THE METABOLIC RATE OF DEVELOPING AMPHIBIA WITH SPECIAL REFERENCE TO SEXUAL DIFFERENTIATION. Irvin A. Wills, State University of Iowa. (Introduced by Emil Witschi.) (Lantern; 10 min.)

The metabolic rate of large numbers of *Triturus torosus* was measured from the time of early cleavage stages until metamorphosis or sex differentiation (determined histologically) had taken place. The animals were kept in constant temperature tanks of $25^{\circ} \pm 1.0^{\circ}$ C. and oxygen consumption measured in groups of ten or singly in older stages at $25^{\circ} \pm 0.05^{\circ}$ C. The metabolic rate is expressed as cubic millimeters of oxygen per milligram of total nitrogen content of animal per hour. The total nitrogen content of the embryo was used rather than surface area or dry weight as a basis of reference. Oxygen consumption was measured by use of Barcroft-Warburg manometers. Total nitrogen content was determined by the improved micro-Kjeldahl method of Cavett with minor modifications.

The average metabolic rate when plotted against time gives a curve similar to heat production curves obtained by other workers for anurans. During the process of metamorphosis there is an increased oxygen consumption and therefore an increased metabolic rate as compared with periods immediately before and immediately afterward. No significant difference was found in the average metabolic rates of thirty-five males (7.40 ± 0.17) and forty-one females (7.82 ± 0.05) at the time of sexual differentiation and at metamorphosis. Therefore sexual differentiation in the Californian newt is independent of the metabolic rate of the entire developing organism. Similar data are being gathered for other species of urodeles and for two species of anurans.

87. THE LARVAL DEVELOPMENT OF RECIPROCAL SPECIES HYBRIDS IN TRITON. V. Hamburger, The University of Chicago. (Lantern; 15 min.)

The urodele material offered itself for a genetic study as it is at the same time favorable for heteroplastic transplantations. Thus both genetic and inductive factors involved in the same developmental process can be analyzed. Reciprocal hybrids of *Triton taeniatus* and *Triton cristatus* can be obtained, however, the mortality of *T. cristatus* ♀ x *T. taeniatus* ♂ is very high in the earliest stages. The hybrids were studied from the beginning of development up to metamorphosis and compared with the larvae of the parental forms with respect to several larval characters and developmental processes. Special attention was paid to the earliest manifestation of hereditary differences. The parental forms differ considerably in the total growth, in the first appearance and growth patterns of limbs and toes, in the first appearance and the pattern of the white pigment in the tail fin, etc. The reciprocal hybrids are identical in the following characters: in the first appearance and growth pattern of limbs and toes (as studied in growth curves) and in the white tail pigment. The *cristatus*-type dominates more or less in this latter character, whereas the limb development is intermediate in some features and follows the *taeniatus*-type in others. The reciprocal hybrids differ considerably in two other characters: their total growth is decidedly maternal, and all the *taeniatus* ♀ x *cristatus* ♂ hybrids display malformations of different degree of both hind limbs, whereas the surviving *cristatus* ♀ x *taeniatus* ♂ hybrids are normal.

By demonstration

88. PITUITARY ACTIVITY AND THE METAMORPHIC PATTERN IN ANURA. William Ekin, College of the City of New York and American Museum of Natural History. (Introduced by L. H. Hyman.)

The relationship of the pituitary to the time and pattern of metamorphic events was studied by transplantation of the gland. *Rana sylvatica* was used. The donors varied in stage of development from one-quarter grown tadpoles to recently metamorphosed animals. The hosts were all hypophysectomized in embryonic stages and used when either half grown or larger than the size normal for metamorphosis. Usually one, sometimes multiple grafts were made. Twenty-six successful cases were obtained of about 100 operations. The following tentative conclusions appear to be warranted: 1) Tissues of all tested stages may persist as functional grafts for at least 50 days. 2) Qualitatively considered, all grafts act alike as all are capable of inducing all the more obvious metamorphic phenomena. 3) Quantitatively the grafts differ. The earlier the stage of the donor the longer it takes for metamorphic phenomena to appear. In all cases the duration of the metamorphic process, especially of the later events, is markedly extended as compared to normal metamorphosis. This slowing of metamorphosis is greater with grafts from earlier stages than from donors in metamorphosis. 4) The stage of the host mattered little if at all for the action of grafts from climax hosts. Comparable data for earlier stages are insufficient for evaluation. 5) Histological examination of the available grafts showed that in general they were smaller and less differentiated than pituitaries from normal animals in the same stage of metamorphosis as the host.

89. THE OVARY OF *BASILISCUS BASILISCUS*. George G. Scott, City College, New York.

This preparation is from a set of transverse serial sections of the ovary of *Basiliscus basiliscus*, a Central American lizard. The animals were about 15 inches in length and were taken in the province of Penonomé, Republic of Panama, about 100 miles southwest of Panama City. The tissue was fixed in the field in Bouin's fluid. The stain is Mallory triple.

The mass of egg-like bodies visible to the naked eye are immature eggs and tissue associated with them. The real ovary or nodule of egg producing tissue can be distinguished in this preparation with the aid of a microscope. Two ovaries are present and both are functional. In each, prospective ova and follicle cells are differentiable. Ova are proliferated one after the other in linear procession from each ovarian nodule and increase in size and change in other respects as they move farther away from the ovarian mass. Characteristic distribution of yolk and cytoplasm of the eggs; changes in the stratum granulosum; and the follicular thecae are seen. All the eggs in this series are very small. Mature eggs are much larger. Those taken from an oviduct measure about 20 mm. in length by 15 mm. in diameter. The continuity of the ovary nodules with peritoneum is shown.

90. A TECHNIQUE AND APPARATUS FOR TAKING INTERMITTENT PHOTOGRAPHS OF LIVING EMBRYOS TO SHOW PROGRESS OF DEVELOPMENT. E. P. Fromm, University of Michigan. (Introduced by Peter Okkelberg.)

The apparatus consists of an electric clock, a toy transformer, a Meccano toy motor, an improvised circuit breaker for shutting off the motor, and a f.1.9 Cine' kodak. The clock turns on the motor and starts the mechanism. This, in going through one revolution, turns on the photo-illumination, sets the camera into action, releases the shutter, turns off the light, and by means of the circuit breaker, turns off the motor itself. The apparatus can be adjusted so as to go off at set intervals, exposing between six and eight frames of film for each revolution of the mechanism. The incubator to which the apparatus is attached, is heated by a flatiron unit controlled by a thermostat.

Both chick and ostrich embryos have been photographed. The eggs are thoroughly cleaned, after which a circular groove of desired diameter is cut in the shell down to the shell membrane by means of a three-cornered file. A ring of paraffin of high melting point is applied around the groove. The shell membrane is cut with sterile cuticle scissors and removed with the shell. The window thus exposed is then closed by a clear, sterile glass plate cut to fit and sealed on to the paraffin ring with melted paraffin. The egg is now ready to be placed in the incubator under the opening of the camera.

By title

91. THE EARLY EMBRYOLOGY OF THE FISH *TRICHOPODUS* (*OSPHROMENUS*) *TRICHOPTERUS*. J. C. Gray, Western Reserve University.

The eggs are small, yellow colored cells measuring about 0.6 mm. in diameter. They are enclosed in a vitelline membrane. The blastodisc is large and some-

what elliptical in shape, forming a polar cap at one side of the egg. Connected with this is a thin film of cytoplasm surrounding the egg. The egg contains a large oil globule about one-half the diameter of the cell and in addition numerous yolk granules. After fertilization the eggs are placed in a nest of bubbles on the top of the water. The eggs are held above the water by the bubbles. The animal-vegetal axis of the egg lies parallel with the surface of the water in the majority of the eggs. It has never been observed to lie perpendicular to the surface of the water. The experimental orientation of the eggs, from fertilization through later stages of development, in various positions with respect to the surface of the water does not interfere with normal development. The egg does not rotate within the vitelline membrane after fertilization.

The first cleavage plane appears perpendicular to the surface of the water and parallel with the polar axis and is completed in about 35 minutes. It is also perpendicular to the anteroposterior axis of the future embryo. The second cleavage plane is perpendicular to the first and is parallel with the anteroposterior axis of the future embryo. The next three or four cleavage planes are perpendicular to the second cleavage plane. The time for the completion of the cleavages becomes less and less until they occupy less than 5 minutes.

The polarity of the egg appears to be well established, at least, by the time of fertilization and is probably established before laying, as evidenced by the polar cap of cytoplasm and the lack in disturbance of normal development following various orientations of the egg prior to and during the early cleavages.

92. THE DEVELOPMENT OF THE KIDNEY OF THE FISH *TRICHOPODUS* (*OSPHROMENUS*) *TRICHOPTERUS*. E. Karolyi, Western Reserve University. (Introduced by J. C. Gray.)

The following is a description of the development and anatomy of the kidney of '*Trichopodus* (*Osphromenus*) *trichopterus*.' The materials studied were collected from the time of hatching up to 78 days.

The first indication of the pronephros is found in the region just behind the otic capsule at the 1-day stage. It consists of a lateral pronephric tubule and a pronephric duct which consists of a series of disconnected cords of cells. Five days after hatching, the pronephros is complete functionally and morphologically. There is one pair of glomeruli which lie in their respective post-cardinal sinus. The entire pronephric tubule is also in the post-cardinal sinus. The pronephric tubule extends laterally, makes a U-shaped turn dorsally and then continues medially. Near the median dorsal line it turns sharply posteriorly and continues backward as the pronephric duct. As the young fish becomes older the pronephric tubule becomes more coiled. When the fish is 12 days old another pair of glomeruli is added. These occupy a space ventral and posterior to the first pair in the post-cardinal sinus. At 18 days the pronephric tubules become more numerous and more coiled. The newly formed tubules extend ventrally rather than posteriorly. There is no indication of degeneration in the older pronephric tubules. The newly added tubules show no structural difference from the former. There are no new glomeruli formed. From the 22-day stage through the various stages up to the 78-day stage the kidney consists of a large mass of convoluted tubules. The glomeruli have increased to five in each kidney. The duct as it proceeds posteriorly is considerably coiled.

93. DIRECT TYMPANIC MEMBRANE FORMATION FROM DERMA-PLICAE INTEGUMENT.
O. M. Helff, New York University.

The writer has previously shown that fully developed anuran dermal plicae undergo complete regression following heteroplastic transplantation to the larva. Subsequent retransplantation to the ear region of metamorphosing larvae results in the development of normal tympanic membranes. Whether such transformation will occur following direct transplantation of dermal plicae to the ear region was tested by the following operations:

Autoplastic *R. clamitans* and *R. palustris* transplantations resulted, in general, in little or no regression of dermal plicae.

Homoplastic transplantations resulted in complete regression in *R. clamitans* and partial regression in *R. palustris*. In the former species, partial, and in the latter, no tympanic membrane development occurred.

Heteroplastic transplantations from *R. clamitans* to *R. palustris* and *R. catesbeiana* resulted in complete regression in both cases, with well-formed tympanic membranes.

Heteroplastic transplantations from *R. palustris* resulted in little regression on *R. clamitans* hosts and no tympanic membrane development. Transplants on *R. catesbeiana* hosts underwent complete regression and tympanic membrane formation.

The conclusions are reached that autoplastic transplantations usually do not result in dermal plicae regression; homoplastic transplantations result in partial to complete regression but without tympanic membrane formation; while heteroplastic transplantations usually involve complete regression and tympanic membrane development.

Initial heteroplastic transplantation to larval hosts is thus not essential, in that direct heteroplastic transplantation from young frogs to the ear region of metamorphosing larvae will result in total regression of dermal plicae structure and complete membrane formation.

94. A STUDY OF THE THYROID IN EMBRYOS OF *ELEUTHERODACTYLUS LUTEOLUS* *NUBICOLA*. W. Gardner Lynn, Johns Hopkins University.

The Jamaican tree toad possesses no aquatic larval stage but lays terrestrial eggs from which the young hatch as fully metamorphosed individuals. During embryonic development fore and hind legs appear at about the same time and develop at nearly equal rates; there are no gills; the broad, heavily vascularized tail disappears shortly after hatching. An investigation of the thyroid was undertaken to ascertain the time of appearance of the gland and the time of first discharge of its colloid and to correlate these with the progress of bodily differentiation in the developing embryo. At a stage when the limbs have already appeared as buds, sections show no indication of the presence of the thyroid. It is not until the toes are clearly differentiated that the primary follicles are organized and actively secreting. The cells are cuboidal, the lumen of each follicle containing a small amount of colloid. At later stages the follicles increase uniformly in size and at the time of hatching fusion of primary follicles has occurred. Many of the cells are now columnar. The changes in staining reaction of the colloid follow their usual course, the droplets in the primary follicles

staining uniformly blue with Mallory's connective tissue stain but later showing red centers and blue borders. From the material available it appears that though active secretion and storage of colloid occurs during embryonic life there is no striking period of discharge of the secretion analogous to what occurs at metamorphosis of ordinary tadpoles.

95. AN OVARIAN CYSTADENOMA AND ITS INFLUENCE UPON SEX DIFFERENTIATION IN AN IMMATURE DIAMOND-BACK TERRAPIN. Paul L. Risley, State University of Iowa.

A single case of ovarian cystadenoma appeared in a year-old female diamond-back terrapin. The adenoma was of a butter-yellow color, spherical in shape, and located in the approximate center and in the medullary tissue of the left ovary. It was glandular, multilobular, and pseudo-mucinous in type. The main lobule contained a large amount of mucinous substance and was lined with a high columnar ciliated epithelium. A comparison of both right and left ovaries of this specimen with those of a normal specimen of about the same age shows that certain anomalies are present. Instead of the well-developed and growing follicles of the normal ovary, the pathological ovary and its mate of the right side show no more than a dozen follicles that are completely separated from the cortex. As many groups of follicle cells contain gonial cells instead of the normal ovocytes. These groups are interpreted as a tendency toward the further formation of seminiferous tubules. The normal regression of the medullary sex cords of the early ovary is also distinctly inhibited. The physiological effects of the benign tumor indicate its origin from the medullary constituents (Sertoli cells or rete cells) of the undifferentiated gonad.

96. ORIGIN OF ASYMMETRY IN THE REPRODUCTIVE SYSTEM OF BIRDS. Emil Witschi, State University of Iowa.

A study of the formation of the indifferent gonads in the chick, the English sparrow and the Red Wing during the third and the fourth days of incubation proves that at the beginning the primordial germ cells are symmetrically distributed. At that time they are located in the widely separated right and left splanchnic plates, posterior to the omphalomesenteric arteries. Later in the third day, when the dorsal mesentery forms, the germ cells from both sides are brought together, collecting at the root of the mesentery. During the immediately following redistribution three to ten times as many germ cells move to the left than to the right side. At the end of the fourth day it is observed that the right cortex contains relatively fewer germ cells than the right medulla. Therefrom it is concluded that the asymmetry of the sex glands of birds is due to a primary, hereditarily fixed, deficiency of the right cortical inductor.

97. THE STORAGE OF TRYPAN BLUE IN GRAFTS OF EMBRYONIC DUCK KIDNEY TISSUE TRANSPLANTED TO THE CHORIO-ALLANTOIC MEMBRANE OF THE CHICK. Carl J. Sandstrom, New York University.

In an effort to show that kidney tissue from variously aged duck embryos could be normal after growing on the chorio-allantoic membrane of the chick

for 10 days, trypan blue was injected into the air chamber of the host shortly previous to the removal of the grafts. The tissue was compared with kidney tissue from normally developed duck embryos of various ages which were also injected with the dye. Trypan blue was found stored in the epithelial cells of the convoluted tubules of both the grafted and control series. It was in the form of either extremely fine granules evenly distributed throughout the cell, or large masses in the distal part of the cell between the nucleus and free border. The first type of storage occurred from the nineteenth day on, the latter, from the twenty-fourth day on. The grafted tissue compared favorably with the controls in all respects except that it was slower in storing the dye. No trypan blue was found either in the cells of the collecting tubules, in the lumina of any of the tubules, or associated with the glomeruli. Necrotic tissue of the grafts contained no dye unless the kidney had already attained a completely functional stage at the time of transplantation, in which case the dye was probably taken into the cells before necrosis occurred.

98. THE DEVELOPMENT OF CHICK EMBRYOS IN A HIGH-FREQUENCY ELECTRO-MAGNETIC FIELD. Carl J. Sandstrom and Norman Hilberry, New York University.

Fertile chick eggs were incubated for 72 hours in a single-layered, openly spaced solenoid which formed the inductance of an undamped high-frequency oscillator. Frequencies of 3.3×10^6 to 5.2×10^6 were used. The complexity of the electro-magnetic field in which development occurred is reflected in the results which varied from normal, but somewhat accelerated, embryos to minute, inhibited forms, and terrata of various types, e.g., microcephalic, omphalocephalic and exencephalic. In most of the embryos a distinct general inhibition of growth was evident. This inhibition acted more intensely anteriorly than posteriorly except in that the tail bud was frequently suppressed. Foldings, which occur in normal development, were also inhibited. Thus the neural folds and the amniotic folds were suppressed; again, more specifically in the anterior part of the embryo. Extra-embryonic blood vessels were occasionally absent, but the heart, although somewhat inhibited in its development, was always represented by a prominent structure. In addition to these general effects, in 30 per cent of the embryos the axes were shifted 5° to 90° from the normal. Of these, 69 per cent were shifted 45° or more. An induced high temperature within the incubating egg probably was responsible for some of these results, but the shifting of the axes suggests an electro-magnetic effect.

99. TIME OF ORIGIN AND METHOD OF FORMATION OF THYMIC CORPUSCLES IN THE ALBINO RAT. Harry A. Charipper and Martin M. Ginsberg, New York University.

A study of serial longitudinal and cross sections of thymus glands obtained from albino rats during various stages of development showed evidence of Hassall corpuscle formation only on or after the seventeenth day of intrauterine life. In many cases, indications of thymic corpuscle were not found before the eighteenth day. Three different methods of formation were noted. One process occurs in association with the differentiation of the gland into its medullary and cortical regions; in this method epithelial cells are carried into the gland by the migration

of connective tissue laminae from the capsule. These cells become arranged about the medullary end of the lumen of the invaginated capsule and is pinched off from the rest of the trabeculum leaving a small lumen about which are found concentrically arranged epithelial cells. A second process consists in an infiltration of epithelial cells about terminal capillaries. In both processes the epithelial cells appear caught in a connective tissue mesh-work and tend to align themselves concentrically round a lumen. A third formation consists in the grouping of epithelial cells, apparently at random, in limited areas of the medulla. Here, again, the cells are caught in a connective tissue mesh-work and become concentrically arranged with no evidence of a central lumen. This study seems to indicate that the presence of a lumen is not essential for the formation of a thymic corpuscle and further that if a lumen is present its occlusion is secondary and not primary in the formation of Hassal's corpuscle.

100. DIFFERENTIATION OF ENDODERMAL DERIVATIVES OF THE RABBIT EMBRYO.
I. LIVER AND PANCREAS. A. J. Waterman, Williams College.

Omental and kidney grafts of whole rabbit embryos of 7 to 10 days' gestation and of more or less isolated rudiments of the liver and pancreas of 9- to 13-day embryos were made to determine the developmental capacities of these tissues at various ontogenetic stages. Liver tissue appears in grafts of 4- to 5-somite stages, pancreas somewhat later at the 9- to 13-somite stages. The endoderm of pre-rudimentary stages does not differentiate. Embryonic segregation has advanced to the survival stage at these times.

Both glands show a progressive type of differentiation up to a certain point. Normal form does not appear and a connective tissue capsule may form around the liver. Otherwise the tubules project outward into the graft. Differentiation of the tubules is quite specific and vascular sinusoids appear in the liver and islands in the pancreas. Grafts of earlier stages contain considerable blood cell extravasation and intratubular connective tissue. Isolated fragments are common. Differentiation of isolated visible rudiments is more typical than in grafts of whole or parts of corresponding stages.

The number of islands in the pancreatic grafts is always reduced and variable. None appear in grafts of 11- to 13-day embryos. Otherwise the pancreas exhibits greater survival capacity than the liver. Grafts of liver rudiments from 11-day and older embryos show increasing retrogressive and degenerative changes. Since the total age of the transplants was 19 to 27 days, these changes may perhaps be correlated with absence of function.

101. DIFFERENTIATION OF ENDODERMAL DERIVATIVES OF THE RABBIT EMBRYO. II. THE LUNG. A. J. Waterman, Williams College.

Isolated and non-isolated respiratory rudiments of 10- to 12-day rabbit embryos show the capacity for specific and regional differentiation in omental and kidney grafts of the same species. Grafts include trachea, bronchi, bronchioles and alveoli. Histogenesis and, to a certain extent, morphogenesis are progressively more typical in grafts of older stages. Comparable differentiations were secured from isolated and small non-isolated transplants, but differentiation of endoderm and its derivatives is poor in transplants of whole, thirds or fifths of the embryo.

Definite respiratory structures appeared for the first time in grafts of whole 8-day stages. Earlier stages gave no differentiations of a specific character. In its first appearance the organ shows slight branching of the original bud. This is increased in grafts of 9-day embryos, but histological and regional differentiation is frequently obscure. The 10-day rudiment gives a more typical picture.

There is greater ability to maintain a high degree of differentiation in old grafts than is true of liver and pancreas. Typical form and lobulation are not attained. The organ differentiates as a unit and is seldom fragmented. Size is always smaller than the control but increases in grafts from older stages.

Differentiation of lung appears to be correlated with development of foregut since in the present experiments this organ appeared only in grafts of embryos in which the foregut was well advanced. Segregation and localization of prospective respiratory material probably occur earlier (compare chick), but the endoderm of earlier stages does not differentiate well.

102. THE COURSE OF GESTATION IN THE GUINEA PIG. A RECORD OF 678 PREGNANCIES.

William C. Young, Brown University.

The exact time of mating or of artificial insemination is known for 678 females. Of these, 283 were mated with normal males or were inseminated artificially with normal spermatozoa, 174 were mated with males whose testes had been subjected to heat injury or were inseminated artificially with heat treated spermatozoa, and 221 were inseminated with spermatozoa which had been aged in the male genital tract. The course of gestation was practically the same for the three groups and the data, therefore, are considered together.

Intrauterine resorptions or abortions were found to be clustered around the 18th to the 20th days, the 30th to the 36th days, and the 51st to the 53rd days. Normal births occurred between the 66th and 71st days, most frequently on the 68th or the 69th day. Each period is very nearly a multiple of the reproductive cycle and the occurrence of abortion or normal parturition as the case may be is attributable to factors which are known to appear at these times in pathological pregnancies and normal pregnancies, respectively.

But another cluster of abortions, separated sharply from the normal parturitions which began a day or two later, occurred between the 60th and 64th days. The factor which is responsible for these abortions is not known, but their occurrence is believed to account for the statement still seen in the literature that the period of gestation in the guinea pig is 62 days in length.

103. CHANGES IN THE PROPORTIONS OF THE CAT FETUS DURING ITS DEVELOPMENT.

Homer B. Latimer, University of Kansas.

A series of 264 fetuses and newborn kittens weighing from 0.3 to 197 gm. was used. The head and trunk are about equal in weight at first but the head decreases to about one-fourth of the weight of the trunk.

The initial and maximum percentage weights of the fore limb are 4.4 and 8.4. The similar percentages for the hind limb are 3.5 and 10.8. The maxima occur at 70 and 100 gm. of body weight, respectively. The ponderal index of the two extremities rises to its maximum of 170 per cent at 1 gm. of body weight and then decreases to 74.

The head and trunk decrease in relative length and the tail increases. The head becomes progressively broader up to 40 gm. of body weight and then more slender. The trunk is most slender in the smallest specimens and it becomes stouter during the fetal growth period.

The forefoot decreases in relative length, the forearm increases and the arm changes but little. The hindfoot decreases likewise but the other two segments of the hind limb change but little in relative length. The distal and the proximal segments do not grow as fast as the middle segment of the appendages. Indices of the homologous segments of the appendages show that the arm is longer than the thigh and the forefoot is shorter than the hindfoot. Both of these indices decrease rapidly at first and then more slowly. The intermembral index likewise decreases from 132 to 99 per cent.

PARASITOLOGY

Read

104. RESISTANCE AND SUSCEPTIBILITY IN COCCIDIAL INFECTIONS. Justin Andrews. Johns Hopkins School of Hygiene and Public Health. (Introduced by R. W. Hegner.) (Lantern; charts; 15 min.)

Non-fatal coccidial infections are roughly divisible into those types, 1) in which the experience eventuates in the development of 'immunity,' and 2) in which the infection becomes patently chronic. In the first instance, the health of the host, if it has been affected, returns to normal, oocyst discharge diminishes to the point of negligibility, and the host is refractory to reinfection with the same species of coccidia. In the second instance, symptoms, if any, subside, but the host continues to discharge oocysts indefinitely, and in some instances at least is susceptible to subsequent infections with the same species of coccidia superimposed upon the original infection. Examples are given of each type. Exceptions to the normal course of events with 'immune' animals are cited and their significance discussed.

Resistance to coccidiosis is indicated not only by the degree of success with which a host rids itself of the infection but also by the varying intensity of primary infections manifested under conditions where oocyst ingestion and physical environment are comparable except for some deliberate experimental modification. The study of miniature epidemics of poultry coccidiosis has contributed useful items of information concerning this phase of resistance and susceptibility. The nature of these findings, their significance in understanding this portion of the protective mechanism, and their practical application will be discussed.

105. THE NATURE OF IMMUNITY IN COCCIDIOSIS. Elery R. Becker, Iowa State College. (Lantern; 15 min.)

Coccidial protein in parenteral injections, transfusions of immune blood, blocking of macrophages, attempts to passively transfer opsonins of bacteriophage, splenectomy, splenectomy and Bartonella, and exposure of the host to cold or heat do not alter the quantitative character of *Eimeria miyairii* infections in the rat.

The feeding of comparatively small and comparatively large doses of the micro-organism shows that the former leads to the development of immunity with the development of a comparatively small number of oocysts and the latter to the same result with the development of a significantly larger number of oocysts.

Evidently the immunity is not to be explained by a generalized response on the part of the host organism. Since the relationship between the numbers of oocysts in the infective dose is not a direct one, it appears that the immunity is not the result of merely the depletion of available epithelial cells in the intestinal mucosa. If the immunity is a purely local defence reaction, the immune principle is capable of spreading from cell to cell, for the development of the immune state is attendant upon either of a moderate number of parasites or an exceedingly large number, depending upon the size of the inoculating dose.

106. THE EFFECT OF AN INCREASED BURDEN OF PHAGOCYTOSIS UPON NATURAL AND ACQUIRED IMMUNITY TO BIRD MALARIA. Wendell Gingrich, The University of Chicago. (Introduced by K. S. Lashley.) (Lantern; 15 min.)

Injections of 1 cc. 50 per cent foreign red cells (chicken, pigeon, duck) during different stages of infections of *Plasmodium cathemerium* in canaries served as a means of 'blockading' the macrophage system. Daily injections for 3 days during the period of acute rise and for 6 days during the periods of incubation and acute rise (i.e., before the crisis) failed to change the daily rate of increase (about $\times 5$) in the number of parasites, although death and phagocytosis of two-thirds of the organisms is known to occur during this period. Daily injections for 3 days beginning at the crisis resulted in death of most birds. Daily injections for 3 days during recovery (beginning 2 days after the crisis) resulted in marked increase in the number of organisms followed by death in about half the cases. Injections for 9 days during the latent period provoked relapse in every case, although the degree varied greatly. It has been demonstrated that phagocytosis of parasitized erythrocytes with proliferation and hypertrophy of macrophages accompanies the process of acquiring immunity to malaria. The results of 'blockade' at the crisis and during the periods of recovery and latency constitute further evidence of the direct action of the macrophages in removing and destroying the parasites. In contrast to this, the failure of 'blockade' to influence the natural immunity (as manifested by the two-thirds death rate during the period of acute rise) indicates that phagocytosis during this period is not the factor which limits the daily rate of increase of the organisms.

107. THE DEVELOPMENT OF ADULT TRICHINAE IN CHICK AND RAT EMBRYOS. O. R. McCoy, University of Rochester. (Introduced by W. W. Cort.) (15 min.)

Trichinella spiralis larvae, obtained free from infected rat muscle by artificial digestion, were sterilized without injury by suspending them in a 1:2000 solution of merthiolate for 5 minutes. Approximately 1000 sterile larvae were injected into the amniotic sac of chick embryos from 6 to 15 days old. About 40 per cent of the embryos survived the inoculation and were examined from 2 to 7 days after the larvae were introduced. Worms in various stages of development up to sexual maturity were found in about 60 per cent of the eggs in which the

embryo still lived. In one instance, a female worm was found which had young larvae developing in the uterus. Only about 1 or 2 per cent of the larvae injected underwent development, and the size attained by the sexually mature worms found after 6 or 7 days was much less than normal. In a second series of experiments with pregnant female rats, laparotomy was performed on what was estimated to be about the fourteenth day of gestation, and sterile larvae were injected through the uterine wall into the amniotic sac of the embryos. Practically all worms found in examinations made after from 2 to 5 days showed the same degree of development and increase in size that would be expected if they had grown in their usual intestinal habitat. In the fifth day after the injection, numerous female worms were found with young larvae developing in the uterus. So far, attempts to obtain development of the larvae in sterile amniotic fluid incubated in vitro have not been successful.

108. THE INTERRELATIONS OF PARASITE AND HOST TISSUE IN EXPERIMENTAL STRONGYLOIDES INFECTION. Ernest Carroll Faust, Tulane University. (Introduced by W. H. Taliaferro. (Lantern; 15 min.)

Studies were conducted on sixty-two dogs infected with human and simian strains of *Strongyloides*, in an attempt to elucidate the progressive damage produced by the worm in the host and the tissue reactions provoked by the parasite. At the site of inoculation on the skin only fibroblastic repair was stimulated, except where dead or dying larvae became surrounded by polymorphonuclear leukocytes. On arrival in the alveoli and respiratory sacs of the lungs, acute leukocytic invasion of the air passages was initiated, but no phagocytosis occurred. The larvae, crowded in by the host tissue elements proceeded to metamorphose into preadolescent and adolescent worms, and at times the females invaded the palisade epithelium of the bronchi. Young females which reached the small intestine invaded the mucosa, where many worms tunneled into the interglandular stroma and oviposited. Adult females, eggs and larvae produced traumatic and lytic damage to the mucosal layer. This provoked a variety of host tissue reactions, including adventitious ensheathment of the worms and eventual phagocytosis, fibroblastic repair of damaged tissue and pseudo-tubercle formation around larvae attempting to penetrate into or beneath the muscularis mucosae.

109. EXPERIMENTS ON THE PASSIVE TRANSFER OF IMMUNITY TO AN INTESTINAL NEMATODE INFECTION, AND ITS BEARING ON LOCAL IMMUNITY. Asa C. Chandler, Rice Institute. (Introduced by F. R. Lillie.) (Lantern; 15 min.)

Experiments are reported on the effect of injection of immune and normal serum on the course of a *Nippostrongylus* infection in rats, on the transfer of immunity from mother to offspring, and on the transfer of immunity from one member to the other in a pair of parabiotic twins.

110. A COMPARATIVE MORPHOLOGICAL AND PHYSIOLOGICAL STUDY OF SOME HAEMOSPORIDIA OF BIRDS. Earl C. O'Roke, University of Michigan. (Lantern; 15 min.)

Experimental studies of haemosporidia of birds, with particular reference to those of game species, extending over a period of 7 years have provided the

opportunity for examining more than 1000 individual birds belonging to approximately forty genera. In the course of these investigations, the complete life histories of *Haemoproteus lophortyx* of the California Valley quail and *Leucocytozoon anatis* of ducks have been determined. These life histories have contributed a wealth of material for comparative study. In this paper, there is brought together data on the morphology of all of the stages of both the sexual and the asexual cycles. Comparative physiological data on the behavior and activity of the parasites, as well as their pathological effects on their hosts are given. On the basis of this comparative data, some conclusions are drawn as to the systematic position and evolutionary relationships of these two genera.

111. THE LIFE HISTORY OF THE BLACK GRUB OF BASS, *CRASSIPHIALA AMBLOPLITIS* (HUGHES). George W. Hunter, 3rd, and Wanda S. Hunter, Wesleyan University. (Lantern; 15 min.)

Experiments started in 1931 resulted in a partial elaboration of the life cycle. The metacercariae, *Neascus ambloplitis*, when fed to young fledgling kingfishers yielded eggs in feces in 44 days and sexually mature flukes at autopsy at 47 and 50 days (Hunter, '33). Later eggs were hatched in about 3 weeks giving a miracidium characterized by twenty-one epidermal plates bearing cilia, numerous subepithelial cells, an apical gland (gut), two pigmented eye spots, two pairs of flame cells opening between the third and fourth rows of plates, germ ball, penetration glands and 'brain.' These forms penetrate *Helisoma trivolvis* (Say) and *H. campanulata* (Say).

Routine examination of 'wild' snails from a heavily infected locality yielded mother sporocysts about 0.3 mm. in length. Young unbranched daughter sporocysts possess a heavy wall and are slightly motile. Older sporocysts are over 2 mm. in length; these are thin walled and are frequently constricted in spots thus separating masses of developing cercariae.

Emerging cercariae penetrate Centrarchid fishes. (Krull, '34 infected *Eupomotis gibbosus* and *Apomotis cyanellus*.) In our experiments the characteristic black pigmented cysts appear about the inner hyaline cysts laid down by the parasite in 22 days in fingerling small-mouthed black bass, *Micropterus dolomieu*. Young rock bass and sunfish were also experimentally infected.

112. EFFECT OF IRRADIATED ERGOSTEROL AND CALCIUM LACTATE ON CALCIFICATION OF TRICHINA CYSTS. W. W. Wantland, Northwestern University. (Introduced by F. D. Barker.) (Lantern; 10 min.)

A series of nineteen white rabbits, including six controls, were fed approximately 5000 *Trichinella spiralis* larvae.

Thirteen rabbits were given by mouth varying relative amounts of irradiated ergosterol and calcium lactate. Treatment continued from 4 weeks to 3 months and 7 days. In rabbits daily given from 16 to 150 drops of ergosterol and 0.5 to 2.0 gm. of calcium lactate, marked calcification of cysts occurred in from 1 month and 10 days to 2 months and 28 days after infection and in from 28 days to 1 month and 7 days after the beginning of treatment.

A daily dosage of 16 to 20 drops of ergosterol and 0.5 to 1.0 gm. of calcium lactate produced a marked calcification of cysts in 28 days from the beginning of treatment and 2 months and 28 days after infection.

A daily dosage of 80 drops of ergosterol and 1.0 gm. of calcium lactate produced marked calcification in 1 month and 7 days after beginning treatment and in 1 month and 10 days after infection.

Treated rabbits, 1 month and 10 days after infection, showed a more marked calcification of cysts than shown in untreated rabbits after 8 to 12 months.

The rate of calcification varied directly with the amount of irradiated ergosterol and calcium lactate given and the length of time of treatment.

Rabbits receiving 100 to 150 drops of ergosterol and 1.5 to 2.0 gm. of calcium lactate died, indicating that too large a dosage might be fatal.

113. LUNG INFECTIBILITY OF LABORATORY ANIMALS WITH PIG AND CAT ASCARIS.
George L. Graham, Rockefeller Institute for Medical Research. (Lantern;
12 min.)

Using graduated doses of infective eggs, essentially an infectivity titration devised by Stoll, it is possible to differentiate susceptibility of laboratory animals to lung damage resulting from larval ascarid migration.

The feeding of *Ascaris lumbricoides* eggs to caviae produces macroscopic lung lesions classifiable by the sixth day as + . . . +++++; the former results from 100, the latter from 5000 eggs. By contrast, in rats, feedings of 5000 to 10,000 eggs are necessary for + lungs, ++ readings being only occasional as the result of feeding 25,000 or more eggs.

In mice strong + and ++ lesions result from 5000 and 10,000 eggs with minimum readings from smaller doses. In chicks, doses up to 5000 eggs produce no lesions, + readings requiring 10,000 to 50,000 doses. Cats were completely refractory to doses of 50,000 eggs, as was a single dog.

The lesions produced in rabbits approximate those in caviae. Damage in the rabbit lung appears as discrete pin-point hemorrhages showing little tendency to spread into blotchy areas as in the case of caviae.

Infective eggs of the cat ascarid, *Toxocara cati*, when introduced into caviae, produce lung damage comparable to *A. lumbricoides* there. In rats, 100 to 500 eggs result in readable + lesions, and at 5000 eggs are comparable to those in caviae. Cats, refractory to pig ascaris, with their own *Toxocara cati*, show lung lesions with 100 and 500 eggs.

The common laboratory animals thus appear to differ widely in their susceptibility to lung lesions with infective ascarid eggs.

By demonstration

114. THE ORIGIN OF THE GENUS DIPLOGONOPORUS LÖNNBERG 1892. Teunis Vergeer, Hope College. (Introduced by George R. La Rue.)

Doubled reproductive organs in each segment is the rule in several families and genera of Cestoda. Doubling of reproductive organs occurs occasionally in species with single sets in each segment. In *Diphyllbothrium latum* occurrence of double sets generally is caused by a fusion of intercalated partial segments. The fused segments are always irregular and the central sets of reproductive organs are not of the same size. One set is always partially in advance of the other.

One *Diphyllibothrium latum* of several hundred reared experimentally had double sets of reproductive organs in most segments, caused by longitudinal division of reproductive primordia. The segments have all the characteristics of the genus *Diplogonoporus*.

The two kinds of segments with double reproductive organs are demonstrated.

While it is not known whether the longitudinal splitting of the reproductive primordia is hereditary, the actual identity of these segments of *Diphyllibothrium* with those of *Diplogonoporus* strongly suggests how the latter genus originated.

Discontinuous distribution may be due to independent identical mutations which persist on different continents.

Planned genetic research has never been attempted with any of the multitudinous variations in tapeworms. With some species six generations can be raised in 1 year in easily kept hosts. The environment can be definitely controlled through the nourishment of the hosts. Self-fertilization prevents introduction of heterozygous stock. Multiple segments provide much study material of each individual.

115. *DIPHYLLOBOTHRUM LARUEI* SP. NOV. AND *SPARGANUM PSEUDOSEGMENTATUM* SP. NOV., TWO CESTODES FROM THE GREAT LAKES REGION. Teunis Vergeer, Hope College. (Introduced by George R. La Rue.)

The adult of *D. laruei* sp. nov. has been raised in a dog. The species is characterized as follows: length and width varying between 47–112 mm. x 10–2.1 mm. depending on the state of contraction. Total number of segments 280. Scolex 2.63 x 1.23 mm., spatulate. Bothria in anterior two-thirds of scolex. Unsegmented neck region. All segments broader than long, posterior borders prominent throughout. Genital atrium median at anterior third of segments, uterine pore opens in separate atrium. Roughened cuticula around atria covers area about 0.38 x 0.43 mm. Two transverse anastomoses in each segment connect the two medullary excretory trunks. Cirrus-pouch 0.157–0.178 mm. x 0.142–0.164 mm., approaches dorsal musculature. Testes 225–400, in single layer in lateral fields. Vitelline follicles 1200–1600. Isthmus below middle of ovary. The unusually large Mehlis' gland extends from ventral musculature anterodorsally beyond ovarian isthmus. Seven or eight uterine loops on each side, the upper lateral to the cirrus-pouch and largest. Eggs average 0.047 x 0.033 mm., operculated.

Eleven sub-adults were raised in a kitten.

Plerocercoids cylindric without surface folds or segmentation. Scolex smooth and extended. Encysted in and on the stomachwall of *Leucichthys* spp. Cysts often stalked.

Sparganum pseudosegmentatum sp. nov.: length 1–110 mm., width 0.5–2.5 mm., body depressed, margins parallel. Many regular cuticular folds resemble segmentation. Internally not segmented. Transverse reproductive primordia evident. Scolex in cysts much contracted and wrinkled, extending in water. Bothria deep, as long as scolex. Mostly encysted in the stomachwall or between the coeca of *Lota maculosa*. Final host unknown.

By title

116. THE PLEROCERCOIDS OF *DIPHYLLOBOTHRIUM LATUM*. Teunis Vergeer, Hope College. (Introduced by George R. La Rue.)

The plerocercoid is described and distinguishing characters are given.

Known American hosts in order of importance are: *Esox lucius*, *Stizostedion vitreum*, *S. canadense*, *Perca flavescens* and *Lota maculosa*. Morphologically identical plerocercoids were found in *E. niger*, while reasons are presented why *S. glaucum*, *E. masquinongy*, and probably some species of trout and landlocked salmon may also serve as hosts.

The host species of fish are common only in northern North America.

The plerocercoids do not occur in white fish, lake trout and various species of herring and chubs from endemic areas.

Plerocercoids are more common in older than in younger fish. They are more common in the flesh of species of *Stizostedion* than in their viscera, while this relationship is reversed in *Esox*.

The plerocercoids may be transferred from fish to fish by one host fish eating the other.

Asexual reproduction of plerocercoids does not occur. Experiments on fish, frogs and toads were negative.

Infested waters are distributed over a belt extending through the southern part of Canada from New Brunswick to southeastern Alaska, with other endemic areas in Minnesota, Michigan and Iowa. Infested fish have never been taken from Lake Michigan and Lake Huron; they occur only sporadically in Lake Erie.

Infested fish are for sale in most large cities in northern North America.

Plerocercoids live in the flesh until it is unfit to eat. There they cannot be killed by long exposure to Roentgen ray. Freezing for 6 days at 0°–10° F. kills them.

117. BLOOD PARASITES OF BIRDS OF THE SYRACUSE (N.Y.) REGION. Reginald D. Manwell, Syracuse University.

A survey of local birds has been made during the past year, the chief purpose being to determine the incidence of blood parasites, and particularly of those belonging to the protozoa. So far the study has covered a total of 325 birds, belonging to twenty-three different species and five orders. Somewhat more than half of the birds caught were sparrows, and the great majority belonged to the order Passeriformes. Parasites found included two species of microfilaria (identity undetermined), at least two species of Leucocytozoa (one of which is undetermined and the other is believed to be new), a number of species of Haemoproteus, at least one (and probably two) species of Toxoplasma, and five species of malarial parasites—*Plasmodium circumflexum*, *praecox*, *cathemerium*, *vaughani* and *polare*, n. sp. *Plasmodium vaughani* was found to be common in robins, and a somewhat different strain of it was isolated from the catbird. *Plasmodium polare*, n. sp., was found in a young cliff swallow, and is apparently not transmittable to the canary. Although about 175 English sparrows were carefully examined, and their blood in many cases inoculated into canaries or into other sparrows, *P. vaughani* was not found in any of them, but it was found that they were experi-

mentally susceptible. Thus it appears that this species of plasmodium, although sparrows may be infected with it in the laboratory, exhibits a considerable degree of host-specificity, for robins are very frequently infected in nature. So also *P. circumflexum* has so far been found only in white-throated sparrows. There are indications too that *P. praecox* exists as a number of different varieties, or that there are other species which closely resemble it. For example, grackles were found infected with a plasmodium resembling *P. praecox*, but two attempts to infect canaries with it failed. A starling was also found infected with a praecox-like organism which was transmitted to canaries, but the laboratory strain of praecox could not be transmitted to other starlings.

118. THE QUESTION OF PERIODICITY IN THE ASEQUAL CYCLE OF PLASMODIUM CIRCUMFLEXUM. Reginald D. Manwell and Fruma Wolfson, Syracuse University.

Since one of the marked characteristics of the malaria parasites of man, and of at least two of the avian species of plasmodia, is the regularity with which asexual reproduction takes place in the vertebrate host, a study has been made of the German strain of *P. circumflexum* to determine whether this species shows any sort of periodicity in the asexual cycle. The technique consisted of counting the number of segmenting stages at regular intervals during a period of 72 hours, and of measuring and charting variations in the mean size of the asexual forms, as determined from camera lucida drawings measured with a planimeter. The infections from which the preparations studied were made were obtained in female canaries, the total number of birds in the series being six. The results showed that although there were marked variations in the proportion of the different asexual forms present at different times, these variations did not correspond in different birds, nor did they exhibit any regularity in the same bird. The studies are being continued, but it appears at present that the German strain of this species at least does not show any marked periodicity in the asexual cycle. An incidental result was the determining of the average number of merozoites produced per segmenter as 19.8 ± 5.34 , the range being from 13 to 30. This is a larger average per schizont than that of any of the other species of avian plasmodia so far determined, but until the average length of time required for a single generation of asexual forms is known it is not possible to state how rapidly this species reproduces, as compared to others.

119. NOTES ON THE LIFE CYCLE OF OPHIOTAENIA PERSPICUA, A CESTODE OF SNAKES. Lyell J. Thomas, University of Illinois.

Studies on the life cycle of amphibian cestodes (Thomas, '34) at the University of Michigan Biological Station demonstrated the presence of tapeworm cysts in the liver and mesenteries of adult frogs. These cysts were digested when fed to frogs. Cysts from the liver of the mud minnow, *Umbra limi*, and adult frogs taken in nature fed to garter snakes developed normally in their intestines.

The eggs of *Ophiotaenia perspicua* 96μ in diameter contain when laid onchospheres 10μ in diameter. *Cyclops vulgaris* and *Mesocyclops obsoletus* infest the eggs which develop in the body cavity to infective procercoids measuring 135μ long in 12 to 15 days. The procercoid does not invert the scolex and the larval hooks are distributed in both cercomer and body. Laboratory reared *R. pipiens*

tadpoles fed infected cyclops had cysts in the mesenteries near the small intestine and in the liver when examined 21 days later. Twenty such cysts fed to six young snakes, *Thamnopsis serralis*, born in captivity produced normal tapeworms in their intestines when autopsied after 32 days. Three of these snakes found dead had the tapeworms sewed into the intestinal and stomach walls.

120. BODY WEIGHT OF SNAILS IN HEALTH AND PARASITISM. C. T. Hurst, Western State College of Colorado.

In a series of five experiments a total of 400 snails belonging to two species were examined. In addition to other experimental procedures, a record was kept of the weight of each individual together with its condition, whether healthy or infected with the larvae of trematode worms. In all five bodies of data the figures for the parasitized individuals consistently average higher than those for the healthy ones. Diseased snails are, on the average, heavier than healthy ones.

Just why this would be true is obscure. It may be due to the added weight of the parasites but such is unlikely because in many cases the parasites replace snail tissue. Another reason may be that younger and lighter snails may escape infection more often than older heavier ones, due to seasonal factors. Young snails hatched after the season for free-swimming miracidia would escape infection until the following season. Another cause of the greater weight of infected snails may be that there is a very high rate of mortality among young and newly infected snails in the parasitized group that would naturally leave a group older and heavier than those that succumbed.

CYTOLOGY AND HISTOLOGY

Read

121. OCTOPLOIDY AND DIPLOIDY IN *MIASTOR AMERICANA*. Alfred F. Huettnner, New York University. (Lantern; 15 min.)

In the third and fourth cleavages of the paedogenetic and parthenogenetic fly *Miastor*, it has been reported by Kahle and Hegner that chromosome elimination and chromatin diminution is taking place in the somatic nuclei, while the nuclei of the primordial germ cells retain their full diploid number of chromosomes.

The parthenogenetic egg of *Miastor americana* has forty-eight chromosomes. There are sixteen large V's, eight rods, eight medium-sized V's and sixteen small V's. The latter can be divided into eight larger and eight smaller ones.

The primordial germ cell which is segregated during the third cleavage, retains its forty-eight chromosomes. However, the somatic nuclei eliminate thirty-six chromosomes during the third and fourth cleavage, so that the early blastoderm is composed of nuclei containing only twelve chromosomes each, namely, four large V's, two rods, two medium-sized V's and four small V's. In the somatic mitoses the pairing of homologous chromosomes is so evident and characteristic, that there is no doubt that the somatic nuclei are diploid. It appears therefore, that there is no chromatin diminution and also no chromosome elimination in the sense in which Hegner used the term. *Miastor* represents a unique case in which the organism adjusts itself to the diploid condition by eliminating chromosomes derived from a polyploid germ cell.

122. THE CHROMOSOMAL ORIGIN OF SPINDLE FIBERS. E. Eleanor Carothers, University of Pennsylvania. (Lantern; 15 min.)

X-chromosomes of short-horned grasshoppers are particularly favorable for the study of spindle fibers for two reasons. 1) In the first spermatocytes they are out of step with the other chromosomes, reaching the physical condition in late prophase of euchromosomes at metaphase. 2) In most species the x-chromosomes are telomitic but in certain species of *Trimerotropis* and allied genera, they are atelomitic while a few individuals have both types as well as intermediate forms in adjacent first spermatocyte metaphases. Keeping in mind the fact that all of the x-chromosomes of a given male are the direct descendants of a single x-chromosome which he received from his mother, a study of the variable individuals revealed the mechanism of shifting and multiple attachments. Delicate pseudopodial-like processes are put forth by the x-chromosomes. Certain of these processes reach the poles and become spindle fibers. These processes correspond to those which all of the chromosomes put forth in stages of diffusion and retract near the end of the prophase. Normally only specialized chromomeres send fibers to the poles at metaphase; but, probably due to its precocious diffusion, processes from other regions of the x-chromosomes sometimes reach the poles and exert definite traction. This, and other evidence, supports the theory that the fibers which pass from the chromosomes to the poles and those which connect daughter chromosomes at anaphase (interzonal fibers) are of chromosomal origin, and thus differ both in source and function from the astral radiations which pass from pole to pole and are of cytoplasmic origin.

123. THE MALPIGHIAN TUBULES OF *ANISOLABIS*. S. I. Kornhauser, University of Louisville. (Lantern; 15 min.)

There is a regular increase in number and size of the tubules during development from eight to about forty-eight. These tubules sprout from four sacculations of the intestine and grow by mitosis. When the tubules begin to differentiate into distinct regions, a lumen develops and the cells assume characteristic structures; brush borders, osmophilic and clear vacuoles. By injecting brilliant-cresyl-blue or neutral fuchsin into living animals and subsequently removing the tubules, the characteristics of the regions and cell structures are best studied. Injection of indigo carmine is especially useful to study the concentration of dye in the tubule and its elimination into the intestine. There are four divisions into which each tube is divided. The free end (segment 1) is thin walled and often balloons up when distended with liquid. The cells of this region do not stain with vital dyes except with Janus green. The second or chief segment is the longest. Its huge hexagonal cells develop many inclusions, become darker yellow as they mature and have tall brush borders. These cells have a great affinity for vital stains and excrete them into the lumen by bleb formation. Small interstitial cells are also characteristic for this region. The third or concentrating segment has thinner walls and fewer inclusions. Here the dyes are found in crystal or granular form. The segment next to the intestinal sacculations is a muscular valvular apparatus which regulates the removal of the material into the intestine. Indigo carmine permits the observation of this process in vivo.

124. DEVELOPMENT OF THE HERMAPHRODITE GENITAL ORGANS OF VALVATA TRICARINATA. Clarence Lee Furrow, Knox College. (Lantern; 10 min.)

From a study of a fresh water prosobranchiate snail, *Valvata tricarinata* local segregation of egg forming and sperm forming areas which coordinate with findings in higher vertebrates has been demonstrated. Of the usual two, only one genital duct system is retained, the so-called hermaphrodite duct which conveys both the eggs and sperms. The distinct oviduct separates off from the spermi duct in the terminal region where the female and male copulatory organs are located. The egg utilizes the proximal part of the hermaphrodite duct. One has the impression that conditions here are largely exhibiting secondary modification.

Protandric rhythm occurs during which the gonad is first male in function. Following a transition phase it then becomes female in function. Because of the hermaphrodite condition the problem of self-fertilization arises; however, the female and male germ cells never ripen at the same time. Single specimens reared in isolation never reproduce. Self-fertilization has not been observed and apparently does not occur.

Spermatozoan polymorphism occurs in this snail. Four different types of spermatozoa are formed in *Valvata tricarinata* of which only one is functional and capable of fertilization. The others show loss of chromatin, abnormal formation, and arrested development. The atypical sperms show a marked tendency toward increasing abnormality in formation. It is concluded that all these changes are of abortive type and that they are related to the hermaphrodite condition of the animal.

125. THE EFFECT OF TEMPERATURE ON THE VACUOME IN NERVE CELLS OF FISH. Ross C. MacCardle, Temple University. (5 min.)

The effect of temperature on the vacuoles in nerve cells of *Fundulus heteroclitus* and *Carassius auratus* was observed in an effort to correlate the cytoplasmic structure with some functional changes (such as, increased metabolic rate and changes in fat and water content). Animals were subjected to temperatures varying from 25° to 55°C. for varying lengths of time. A state of heat rigor occurred at about 38°C. Cytological preparations were made according to the following methods: Dietrich; Cajal; living cells stained with neutral red and subsequently fixed with osmic acid vapor according to Covell and Scott.

The cytoplasm in nerve cells of normal animals show relatively few clear vacuoles, found mainly near the nucleus, in Dietrich and Cajal preparations. Neutral red granules in living cells appear throughout the cytoplasm.

After treatment with heat rigor temperatures (37.5° to 39°C.) the clear vacuoles (in Dietrich preparations) increase in number but not in size. Neutral red granules in living cells increase in number. The largest number of vacuoles and neutral red granules appear near the nucleus. After osmication of the living cell, a clear vacuole appears around each neutral red granule.

During heat rigor and death (40° to 55°C.) the vacuoles and neutral red granules increase in number until the cytoplasm is almost filled with them. It is difficult to determine whether the smaller vacuoles remain separate until the cytoplasm disintegrates, or whether they coalesce to form larger vacuoles.

126. TEMPERATURE VARIATIONS AND HISTOLOGICAL CHANGES IN THE THYROID GLANDS OF FROGS. Opal M. Wolf, University of Wisconsin. (Introduced by M. F. Guyer.) (Lantern; 7 min.)

The cells of the thyroid epithelium of adult laboratory frogs (*Rana pipiens*), placed in an ice box February 22nd for 49 days at 0 to 2°C., varied in type from high cuboidal to columnar with basal, oval, lightly staining nuclei. The colloid showed peripheral 'absorption vacuoles.' Glands of frogs in the ice box from June 23rd to July 11th at 0° to -2°C. appeared the same. Immature *Rana palustris* 10 to 13 cm. in length, collected early in April and kept in the ice box until July 11th showed a gradual absorption of the stored colloid resulting in collapsed follicles but the epithelium remained columnar.

Control animals, in a warm compartment at 90°C. for 10 to 12 days developed thyroids having low cuboidal to squamous type of cell, with deeply staining flattened nuclei, and few absorption vacuoles in the colloid. Likewise immature and mature animals collected during the summer had thyroids with low cuboidal epithelium and a marked absence of absorption vacuoles.

The tallest epithelium and the greatest loss of colloid were found in the thyroids of certain frogs collected during the breeding season. Such active glands were comparable to those of animals which had been stimulated by anterior pituitary.

In comparison with the stimulated glands, the thyroids of the chilled animals appeared to be absorbing stored colloid while animals in the warm compartment seemed inactive in this respect. Whether temperature acts directly on the thyroid or indirectly through the pituitary gland is not known.

By demonstration

127. THE CHROMOSOMAL ORIGIN OF SPINDLE FIBERS. E. Eleanor Carothers, University of Pennsylvania.

See abstract no. 122.

128. THE SPIRAL TENDENCY IN STRIATED MUSCLE. C. W. Robertson, New York University. (Introduced by M. H. Harnly.)

From time to time various workers have reported spiral structure in striated muscle. Certain of the head muscles of *Drosophila* which are composed of a single muscle fiber each, form excellent material for observing this structure. The muscle fibers are so thin that they may be found unsectioned through a considerable portion of their length even in thin histological sections. In such muscles of the nearly mature pupa it has been possible to observe the Q band proceeding in what appears to be a spiral course from one end of the fiber to the other. The dimensions are so small that the spiral can be seen under oil immersion almost without altering the focus. All fibers do not show the spiral structure for some properly oriented fibers show rings of the anisotropic substance under conditions that seem to preclude the possibility of a sectioned helix. The central portion of the fiber is devoid of striae and contains the nuclei. Hence there can be no spiral membrane such as that described by Tiegs for vertebrate material.

129. STRUCTURE OF SALIVARY GLAND CHROMOSOMES IN SCIARA. C. W. Metz and E. H. Gay, Carnegie Institution of Washington and Johns Hopkins University.

In aceto-carmin preparations chromosome organization appears distinctly different according to how material is dissected. Dissection in body fluid or fixative results in segmental organization resembling series of compressed biscuit-like vesicles of various degrees of thickness. Organization is definite and constant for homologous chromosomes. Relation of these structures to delicate discs or bands appearing after other methods of preparation is illustrated. Paired condition of bands in many cases seems to have significant relation to biscuit-like segmentation.

Longitudinal, thread-like lines, connecting 'granules' in successive bands as described by previous workers, appear in our material to be discontinuous, branched and part of a honey-comb-like system which presumably is reflection of an alveolar structure in the living chromosome. Although significance of the 'granules' in the bands is not clear our results suggest that they bear a definite relation to the underlying protoplasmic structure and perhaps do not represent separate structural units themselves.

130. CYTOLOGY OF THE NEPHROSTOME OF LUMBRICUS. Hope Hibbard, Oberlin College.

The nephrostomes of living *Lumbricus* are mounted in hanging drops, in the centrifuged blood of the animal itself, or in a Mine's solution containing M/16 concentration of salts. This is then sealed with Salvoline over a depression slide. Precautions to keep the preparations sterile should be taken. In this condition the cilia are active for days, and the cells may be examined unstained, or stained with neutral red or any other vital dye. The preparations, in addition to offering excellent material for study of the cells under varying conditions, make excellent demonstrations for classes in elementary zoölogy studying this form.

By title

131. CYTOLOGICAL STUDIES ON FLAME CELLS IN TREMATODES. Charles H. Willey, New York University.

In a recent paper, Beaver ('29) has expressed doubt concerning the conventional interpretation of flame cells as ciliated structures. In the present study, 470 flame cells in serial sections of larval or adult stages of ten different species of trematodes have been studied. Material was fixed in Helly's fluid, sectioned in paraffin at 5μ in thickness, and stained in iron haematoxylin and eosin or iron haematoxylin alone. The flame is longitudinally striated and is definitely composed of long cilia. These appear fused in some cells to form a membranelle, while in others the cilia are separate units throughout their length. In some cells only the terminal portion of the flame is frayed showing the ends of individual cilia. The membranelle appears in living cells as a homogeneous structure, but the action of fixing fluids frequently causes it to separate into its constituent cilia. At the base of the ciliated cone there is a row of basal corpuscles from which the cilia arise. In sections that have been destained to

the right degree the row of corpuscles can be resolved into individual granules. The granules and the roots of the cilia are arranged in a ring around the base of the cone. There is a definite canal extending through the center of the flame, as previously observed by Beaver. The cilia form the walls of a hollow vibratile cone.

132. THE RETENTION OF CARBON BY THE THROMBOCYTES OF NECTURUS FOLLOWING INTRAVASCULAR INJECTIONS OF INDIA INK: A INDICATION OF THE LENGTH OF LIFE OF THE THROMBOCYTE. Alden B. Dawson, Harvard University.

A previous study has demonstrated the capacity of the amphibian thrombocyte to store carbon (Dawson, '33). Carbon-bearing monocytes and neutrophilic leucocytes disappeared relatively rapidly from the circulation, but thrombocytes with stored particulate matter persisted for long periods. The animals were splenectomized and a single injection of 0.75 cc. India ink, diluted with three volumes of water, was used. Three days after the injection 60 to 65 per cent of the thrombocytes contained carbon. At 23 days after the injection the percentage of thrombocytes with carbon had dropped to 42 per cent; at 33 days to 24 per cent; at 52 days to 13.6 per cent; at 85 days to 9.5 per cent; at 117 days to 6.9 per cent; and at 140 days (the time of writing) to 4.7 per cent. These figures do not give a true picture of the rate of disappearance of carbon-bearing thrombocytes since new thrombocytes may be differentiated even after splenectomy and some multiplication of existing thrombocytes may occur through mitotic and amitotic activity. Thrombocytes with the greatest accumulations, presumably older cells, disappeared earliest. These incomplete data indicate that the life span of the thrombocyte within the circulation is probably greater than 140 days.

133. THE CYTOLOGICAL CHANGES IN THE HYPOPHYSIS CEREBRI OF THE GARTER SNAKE (*THAMNOPHIS RADIX*) FOLLOWING THYROIDECTOMY. Kenneth Siler, University of Kansas. (Introduced by Homer B. Latimer.)

Changes in the hypophysis cerebri of the garter snake, *Thamnophis radix radix* Baird and Girard, were found only in the anterior lobe of the nineteen thyroidectomized animals studied. Alpha and beta cells of the anterior lobe of the normal animal are similar in shape, the latter type of cell being somewhat smaller. The granules of the alpha cells are larger and tend to clump in irregular masses; the granules of the beta cells are fine. The usual tinctorial differences are found. Non-granular chromophobes are scarce in the anterior lobe of the snake. Those cells which have a small volume of sparsely granular cytoplasm and a large nucleus, making up the bulk of the anterior lobe, are considered to be the typical chromophobe cell in the snake. Changes which occur as the result of thyroidectomy are; a) A transformation and enlargement of the chromophobe cells with an accumulation of basophilic granules to form, as a final stage, functional (?) beta cells. b) Vacuolation of the beta cells with a loss of their fine granules to form a large non-granular cell, whose remaining cytoplasm is chromophobic. c) Degeneration of these transformed beta cells; the final form being a small cell with pyknotic nucleus and a very small rim of non-granular, non-staining cytoplasm. d) A reduction in the number of alpha cells. The hypophyses of animals kept at 90°F. after thyroidectomy do not show degeneration of beta cells to the same degree that glands from animals kept at 70°F. do.

134. THE CHROMOSOMES OF THE MALE MUSK TURTLE, *STERNOTHERUS ODORATUS* (LATREILLE). Paul L. Risley, State University of Iowa.

A study of the chromosomes in the spermatogenesis of the musk turtle indicates that the diploid number is fifty. The spermatogonial divisions reveal four large V-shaped chromosomes, the remainder varying from long rods down to small dot-like chromosomes. Primary spermatocytes show the presence of twenty-five tetrads, and secondary spermatocytes in metaphase also show twenty-five bodies. Anaphase groups of the last maturation division likewise show twenty-five chromosomes. No evidence of sex chromosomes in the male appears. It seems probable that the male sex in the turtles is homogametic and the female sex heterogametic, although proof of this remains to be sought in the female chromosome complex. It may well be that no sex chromosomes are visible in this group of animals since the embryos show a definite juvenile hermaphroditism.

MORPHOLOGY

Read

135. SOME REMARKS ON THE FRESH WATER JELLYFISHES, LIMNOCNIDA AND CRASPEDACUSTA. H. B. Fantham and Annie Porter, McGill University. (Introduced by George R. La Rue.) (Lantern; 10 min.)

Specimens and photographs of *Limnocnida rhodesiae* Boulenger and *Craspedacusta sowerbii* Lankester were exhibited. *Limnocnida* occurs in lakes and rivers in Africa and India; *Craspedacusta* occurs in Europe, America, China and Japan, and so has the wider distribution. The medusae measure up to 25 mm. in diameter, those of *Limnocnida* being somewhat the larger. Medusae of *Craspedacusta* from artificial collections of water are smaller than those from open, natural waters. A hydroid stage, formerly called *Microhydra ryderi*, occurs in *Craspedacusta* but no hydroid stage is known for *Limnocnida*, which has manubrial budding in its medusa. Morphological differences between the genera should not be stressed too much, but the manubrium in *Limnocnida* is short, wide and without lips and so the mouth is larger than in *Craspedacusta*. The gonads in *Limnocnida* are on the manubrial ectoderm and in *Craspedacusta* on the radial canals, a difference probably correlated with the size of the manubrium which causes relative shortening of the radial canals in *Limnocnida*. Several species of each genus have been described but the specific differences are not marked and probably there is only one species of *Limnocnida* and one of *Craspedacusta*, each with a number of local varieties.

The geographical distribution of *Limnocnida rhodesiae* has recently been extended southward by our finding it in the Hartbeestpoort Dam on the Crocodile River, near Pretoria and in Bezuidenhout Valley, Johannesburg; we also obtained specimens from Prince Edward Dam, Hunyani River, near Salisbury. *Limnocnida* exemplifies affinities between African and Indian faunas.

136. THE PSEUDOSTERNITE OF THE GRASSHOPPER AS AN AID TO CLASSIFICATION. L. Gertrude Morrison, State University of Iowa. (Introduced by R. L. King.) (Lantern; 10 min.)

It has been suggested by Walker and by Chopard that a study of the concealed genitalia of male grasshoppers would be helpful in taxonomic studies. Hubbell has shown that these concealed genitalia may be prepared for study without destroying the specimens and has published the results of his studies in certain species of *Melanoplus*. The work to be reported here includes a study of the pseudosternite in thirty-three species representing three sub-families of the Acrididae: Acridinae, Oedipodinae and Cyrtacanthacrinae. Enough specimens were examined in a few cases to establish the fact that the pseudosternite is a remarkably constant structure, varying to no greater degree than other structures commonly used in classification. The pseudosternite in the Oedipodinae as a group is definitely different from that in the Cyrtacanthacrinae, while that in the Acridinae shows an intermediate condition. Individual species, especially the fifteen species of *Melanoplus* studied, are not difficult to identify because of the striking characteristics of the pseudosternite.

137. THE COMPARATIVE ANATOMY OF THE ADRENAL-SYMPATHETIC COMPLEX. Daniel Paul Quiring, Western Reserve University. (Introduced by A. H. Hersh.) (Lantern; 10 min.)

This paper treats of the comparative anatomy of the adrenal-sympathetic complex in a number of vertebrate animals including the alligator, the bird, opossum, armadillo; various rodents, Carnivora, including the lion and the tiger, ungulates including the Humboldt monkey, chimpanzee and man. The changing relations between adrenal and sympathetic system as well as modifications in the vascular supply are demonstrated for the vertebrate series. An attempt is made, on the basis of relative adrenal weight data to correlate the energy pattern of animals with the degree of adrenal sympathetic-complex development. Dissections and weight data from a large series of animals forms the basis for the conclusions arrived at.

138. FACTORS CONTROLLING THE FORM AND COLOR OF SCALES ON THE REGENERATED TAILS OF LIZARDS. G. K. Noble and H. J. Clausen, American Museum of Natural History. (Lantern; 15 min.)

The scales covering the regenerated tails of gekkonid lizards have a different form from those of the original tail. Transplantation of integument and underlying tissues from different parts of the body shows that the scale form of the regenerated tail is controlled partly by the place of origin of the integument proliferating to cover the tail and partly by the underlying tissues. In *Tarentola mauritanica* and *Hemidactylus brookii* the ventral surface of the regenerated tail is normally covered with scales much wider and relatively shorter than those of the dorsal surface. Implanting muscular tissue from the ventral half of the tail under the dorsal integument of the tail stump induces large scales to form dorsally on the regenerated tail. Implanting ventral integument of the original tail to the dorsal surface of the stump has a similar effect. Conversely, dorsal

integument or dorsal muscles of the tail induces small scales to form on the ventral surface. Lower jaw or belly integument produces large scales on the dorsal surface of the regenerated tail. Dorsal head integument produces smaller scales when similarly transplanted.

Pigmentation of the regenerated tail is controlled by the degree of pigmentation in the transplanted integument and not by the underlying tissues. The direction of the scales on the tail is controlled by the axis of the animal and not by the orientation of the transplant. Irregularities in scale size, especially toward the tip of the regenerated tail, may be explained by the smaller amount of muscle in these areas.

139. THE RELATION OF THE NUMBER OF MYOTOMES AND VERTEBRAE TO THE LENGTH AND FLEXIBILITY OF THE BODY IN FISHES. Edward P. Churchill and Harold D. Kautz, University of South Dakota. (10 min.)

The shape of the myotomes of the king salmon has been described by Greene and Greene. The myotomes of several species of fresh water fishes were dissected out in the present investigation and their shape corresponded in general to that in salmon, which is that of a 'W' lying on one side with the two 'V's' pointing posteriorly.

The number of myotomes and vertebrae were counted in sixty-four specimens comprised in twenty-one species ranging from the gar through several Salmonidae, carp and other Cyprinidae, bullhead, perch, northern and wall-eyed pike to sunfish and crappies.

The number of myotomes and of vertebrae was practically the same in any one fish. There was a direct correlation between the number of myotomes and vertebrae and the length of the fish as among the various species. The number of vertebrae and myotomes was almost constant in any one species.

Using a gradation or index of flexibility supplied by Breder, it was found that the greater the number of myotomes and of vertebrae the greater the flexibility of the fish.

There was some evidence that the smaller the angles of the 'V's' and of the center of the 'W' of the myotomes the greater the degree of flexibility of the fish. This would arise from the fact that the smaller the angles the greater the number of vertebrae over which the myotomes would extend and consequently (Greene) the greater would be the bending produced by the contraction of any one myotome.

140. THE MECHANICAL FORCES INVOLVED IN THE EVOLUTION OF THE FISH BODY FORM. John Edward Harris, Columbia University. (Introduced by George R. La Rue.) (Lantern; 15 min.)

The more obvious changes which have taken place in fish evolution are those accompanied by changes in shape of body, and in structure, size and position of fins.

The earlier fish types had bodies of semicircular cross section, and in sagittal section were very similar to a modern aerofoil. When moving through the water, even though horizontal such a body form would exert an appreciable lifting force, though the lack of static stability made it essential that there should be

developed organs for the control of rotation in a vertical plane (pitching movements). The flexure of the tail probably came first, and the pectoral fins seem to have developed subsequently in the form of enlargements at points of low pressure on the body surface. The best living examples of a more or less efficient 'heavier than water' type are to be found in the primitive sharks.

The later development of the teleost, culminating in the evolution of speedy pelagic forms, is characterised by the production of an almost symmetrical body form, of the same specific gravity as the surrounding medium, and by the migration upward of the pectoral fins, accompanied by a rotation of their basal axes. More efficient body streamlining is attained, not only by the alteration in shape, but also by the elimination of eddy formation at the posterior end. This is made possible by the injection of high pressure water jets from the opercula along the surface of the body. The development of a lateral keel on the tail eliminates the unstable vortical flow around the cross section of the caudal peduncle.

By title

141. A NOTE ON THE ANATOMY AND HISTOLOGY OF A GIANT NECTURUS. Emory S. James, New York University and Miami University. (Introduced by Edward L. Rice.)

This study was made on a giant *Necturus* 7 to 8 months old measuring 122 mm. in length, which was received in a shipment from Meadville, Pennsylvania. The giant, produced by special feeding, was compared with a specimen of the same age and with one of the same length. The specimen of the same age as the giant measured only 41.5 mm., while the specimen of the same length proved to be 4 years old. In general the giant specimen showed a uniform growth, with only a slight deviation toward a thicker body and comparatively shorter appendages. The pronephric structure usually associated with normal specimens of the same age had entirely disappeared in the giant. The müllerian duct, which normally does not enter the cloaca until the third year, could be traced from the ostium to the cloaca in the 7- to 8-month-old giant specimen. In addition, well-differentiated ova, approaching the development of the ova in the 4-year-old specimen, were present in the ovaries of the giant. The thymus of the giant specimen contained numerous large well-rounded cells rich in granular eosin staining cytoplasm surrounding a well-defined eccentrically placed vesicular nucleus. The entire study points toward a nearly uniform accelerated growth accompanied by an equally rapid differentiation.

142. THE SUPRANASAL SAC OF THE VIPERINAE. W. Gardner Lynn, Johns Hopkins University.

In a previous study the author has described the morphology and innervation of the facial pit of the pit vipers. Since that time H. W. Parker has called attention to the existence of a somewhat similar organ in certain snakes of the sub-family Viperinae and the present study is an attempt to throw some light upon the possible homologies of these structures. The facial pit of the *Crotalinae* is situated just anterior to the eye; it consists of two chambers both open to

the outside but separated from each other by a thin membrane. The latter possesses a rich nerve supply derived chiefly from the supramaxillary branch and partially from the ophthalmic branch of the trigeminal nerve. The similar organ found in the Viperinae is present only in the members of three genera: *Bitis*, *Pseudocerastes* and *Causus*. It is a simple sac situated beneath the supranasal scute and thus possesses neither the inner chamber nor the pit membrane which are characteristic of the Crotaline pit. Its nerve supply is derived entirely from the ophthalmic branch of the trigeminal. In view of the differences in structure, position and innervation it is concluded that these organs are not homologous but separately evolved structures.

143. THE INFLUENCE OF HEREDITARY DWARFISM ON THE DIFFERENTIATION OF THE SKELETON OF THE MOUSE. Alden B. Dawson, Harvard University.

In hereditary dwarfism of the mouse growth is practically suppressed after the end of the second week of post-natal life and the process of skeletal differentiation greatly retarded. The degree of retardation has been determined by taking as a standard the stage of differentiation attained by normal litter mates at 6 to 8 weeks of age. Normally at this period epiphyseal union is progressing rapidly at the distal end of the humerus, the proximal end of the radius and the distal ends of the tibia and fibula. In the dwarf mice at the age taken as a standard, the level of differentiation of the skeleton is comparable to that of a normal animal 7 to 9 days old, and the stage of skeletal differentiation attained by normal animals at 6 to 8 weeks is not reached by the dwarf until it is from 6 to 8 months old. Diaphyso-epiphyseal union is not suppressed, at least in the group of epiphyses which normally unite earliest in the mammal.

144. FURTHER STUDIES OF THE HISTOLOGICAL VARIABILITY OF HUMAN HEAD-HAIR. Leon Augustus Hausman, New Jersey College for Women.

In the American Journal of Physical Anthropology, vol. 18, no. 3, p. 415 there is recorded the results of a microscopic study of 400 shafts of human head-hair with reference to the variability of their histological structural elements. A continuation of this study, using 400 additional hair shafts from four different regions of the head of the same individual (female, in this case) further substantiates what the earlier study indicated. This is that the variability among the histological elements of the shafts of hair from a single individual head is usually great; too great, in the writer's opinion, to warrant personal identification from merely a few shafts of hair, unless there are present structural peculiarities of hair-shafts, such as sometimes occur, e.g., an abundance of the cortical fusi (the so-called air vesicles), irregular chambers in the medullary column, or some characteristic arrangement of the cortical pigment granules, etc. Such individual peculiarities of hair-shaft structure may be used as personal identification, but should be used with great precautions and study. The histological elements of hair-shaft structure to be considered in a study of hair-shafts are: cuticular scales, cortical cells, medullary column and its component chambers and pigment granules, the cortical pigment granules and their patterns, and the cortical fusi, or 'air-vesicles.'

145. HOMOLOGY AND ITS GENETIC BASIS. Alan Boyden, Rutgers University.

Genetics is that branch of biology which deals with the origin and transmission of the characteristics of organisms. So defined it is a most fundamental division of biology and should be expected to throw light on the more descriptive branches of biological science such as morphology and taxonomy. A basic principle of both comparative anatomy and taxonomy is homology. Current usage defines homology as essential structural similarity due to inheritance. Homology is therefore a genetic phenomenon, a result of gene action. Knowledge of gene action should contribute to the recognition and understanding of homology. As a matter of fact Duerden, examining homology from the genetic viewpoint, states that genetic homology is a delusion and this conclusion is supported by Crew. Both are wrong. Genetic homology is a reality which depends on the fact that complex organs such as the eye or wing of a fruit-fly are each dependent upon the interaction of many genes, change in any one of which or even in many of which does not make the altered structure non-homologous with the ancestral condition. Genetic knowledge does not therefore deny the existence of real homology. In fact it may aid in the determination of homologies and taxonomic relationships also in a limited way through methods of identifying the genes responsible for structures supposed to be homologous. Such methods are more applicable to plants than to animals because wider crosses are possible in the former.

PROTOZOÖLOGY

*Read*146. CYTOLOGICAL STUDIES OF THE GENUS *CHILODONELLA* STRAND. No. 2. Mary Stuart MacDougall, Agnes Scott College. (Lantern; 10 min.)

As a preliminary for further experimental work, a cytological survey of the genus *Chilodonella* is being made with especial reference to conjugation and division phenomena as well as species characteristics. It has been found that the six species studied to date fall into three series: 1) The cucullulus series in which the animals have ventral ciliation, more or less uniform, and the nucleus, elliptical in shape, is centrally located. 2) The uncinatus series with specialized ventral ciliation, and the nucleus, round in shape, posteriorly located. 3) The labiata series is intermediate between the other two types, having the specialized ciliation of uncinatus, and a nucleus with the shape and position of cucullulus.

A comparison of the three series reveals the following facts. In the division and reorganization stages, labiata shows very clearly the phenomena of chromatin elimination. The other two series show this only slightly. Elimination of chromatin in the first maturation division of the micronucleus during conjugation for uncinatus was described by the author in 1925. It is characteristic of all three species.

During conjugation, the macronucleus as well as the micronucleus is exchanged in the labiata series. The other two series do not show this.

Favorable material has been obtained which makes possible the working out of early spireme and synapsis stages.

The diploid number of chromosomes for all three series is four.

147. LAG IN THE DIVISION TIME OF *PARAMECIUM CAUDATUM*. George A. Smith, Carnegie Institution of Washington. (Lantern; 10 min.)

The term lag as used here means a retardation of growth preparatory to division of paramécia.

Individual *Paramecium caudatum* were isolated for 72, 96, 120, 144, 168 and 196 hours in a single drop of culture medium that was optimum for division. Usually the paramécia had ceased optimum division at the end of 48 hours. A number of animals taken from each of these cultures were again isolated singly into one drop of culture medium optimum for growth, and the division rate for each was recorded at various intervals during 20 hours and for a few during 35 hours. Likewise, animals dividing at an optimum rate (every 9 hours) were used as control. Experiments were conducted with animals on depression slides in sealed moist chambers at 25°C.

When paramécia were isolated from old cultures (animals not dividing at the optimum 9-hour rate) results indicated a definite lag. In the control where paramécia were dividing at an optimum rate when transferred into the fresh medium, there was little if any lag noticed; while these control animals produced more than four generations in 20 hours, the 96-hour-old paramécia produced less than two generations during the same 20 hours; and in 35 hours the 168-hour-old animals produced less than one generation, and only about one-third of the 196-hour-old paramécia survived long enough to divide at all.

Lag is possibly due to the physiological condition of the animal as well as changes in environment. The older the paramécia when transferred to the fresh culture medium, the longer the lag period.

By demonstration

148. THE CONJUGATION OF *PARAMECIUM TRICHIUM*. William F. Diller, Dartmouth College. (Introduced by D. H. Wenrich.)

The nuclear behavior of two races of *P. trichium* from the vicinity of Hanover, New Hampshire has been investigated. Three micronuclear divisions lead to the formation of the functional gamete nuclei. The number of nuclei at any stage depends on, 1) whether the preconjugal was a monomiconucleate or a bimiconucleate individual, and 2) the extent of nuclear degeneration during the process. The most distinctive spindles are the first pregamic figures. Crossing over of the gamete nuclei from one conjugal to the other has not been observed.

The macronucleus begins to degenerate at an early period by developing a skein configuration which consists, eventually, of a very elaborate system of interlacing strands. One of the striking features in the conjugation of the races studied is the crossing over of the strands of the old macronucleus from one conjugating member to the other. The exact relation on the onset of this macronuclear transfer to the time when syncaryon formation occurs, has not been fully determined.

The conjugalants separate during the third metagamic division. By this time the old macronuclear skein has fragmented into numerous small sausage-shaped bodies. Four of the eight nuclei become macronuclear anlagen, three degenerate and one remains as the functional micronucleus.

The micronuclear behavior of *P. trichium* is so similar to that described by Doflein for *P. putrinum* that, so far, it has been impossible to distinguish between *P. trichium* and *P. putrinum* on the basis of differences of nuclear activity during conjugation.

149. AN AMOEBA-LIKE PARASITE IN THE MALPIGHIAN TUBULES OF THE GRASSHOPPER MELANOPLUS DIFFERENTIALIS. R. L. King and A. B. Taylor, State University of Iowa.

No abstract received.

By title

150. THE STRUCTURE OF CYTTARO CYLIS ACUTIFORMIS. Arthur S. Campbell, St. Mary's College.

Cyttarocyliis acutiformis has a long lorica (200 to 257 μ). The collar is a short, inverted, truncated cone with flattened sigmoid contour. The bowl is convex conical and the aboral end is pointed. The wall is reticulated with sub-uniform secondary polygons. Loricæ with adequately preserved inhabitants from the Humbolt Current off Galapagos have twenty large, squarish membranelles each of which has similar structure to that described for *Stenosemella* (Campbell, '31) but triangular organelles are, in this present species, lacking. The body is trumpet-shaped, the frontal field is saucer-like with a thick, scalloped brim, and the peduncle is short. There are numerous vertical subsurface ciliary lines. The twenty rounded or pyriform, independent macronuclei wind in a spiral within the body. The infundibulum is short. A typical neuromotor apparatus with a minute motorium occurs. In binary fission there is a large aggregation of coarse lorica-forming granules in the infundibular region, and a lateral daughter anlage occurs. The macronuclei divide independently but synchronously.

151. STRUCTURE OF LIVING ZOOXANTHELLAE. William L. Doyle, Johns Hopkins University. (Introduced by S. O. Mast.)

Symbiotic zooxanthellae of the coelenterate *Cassiopoeia* and of the foraminiferan *Orbitolites* have previously been studied almost exclusively with fixed material. By observation of these zooxanthellae in the living condition two new items concerning their structure were ascertained. 1) There are normally present in the cytoplasm of the zooxanthellae numerous crystals of calcium oxalate. 2) The oil droplet present in the cytoplasm which in high light intensities is small and colorless becomes red and increases in size in low light intensities.

The pigment and the crystals of the zooxanthellae are definitely correlated with the calcium metabolism of the foraminiferan. In the cytoplasm of calcareous foraminifera devoid of zooxanthellae there are present crystals of calcium oxalate and pigment globules which respond to various light intensities in the same manner that the crystals and pigment respond in the cytoplasm of the zooxanthellae in foraminifera containing them.

152. THE FUNCTION OF THE NEUROMOTOR SYSTEM IN THE PARASITIC CILIATE *ICHTHYOPHTHIRIUS*. Ronald F. MacLennan, State College of Washington.

The morphological changes in the neuromotor system were studied in all stages of the life cycle by the use of the standard haematoxylin methods and by the 'silver-line' methods. Dedifferentiation occurs during the encysted stage and the oral region, including the neuromotorium, and the anterior and posterior connections of the longitudinal ciliary fibrils are resorbed. The rows of body cilia thus lose morphological connection with each other during the greater part of encystment. The anterior and posterior connections are reestablished just before excystment and the mouth parts are completely redifferentiated 24 to 72 hours after excystment. The behavior of the living ciliates before the anterior and posterior connections are established and their behavior afterward contrasts sharply. If the ciliates are freed from the cysts before the fibrillar connections are reestablished, their swimming movements are slow, awkward and in no definite direction. If they are freed after the fibrillar connections are established their movements are clear-cut, rapid, and in straight lines. This change in behavior, correlated with the changes in the fibrillar connections of the cilia, is additional evidence that the cilia are coordinated by means of the fibrils of the neuromotor system.

153. RELATION BETWEEN THE RATE OF FORMATION OF THE FOOD VACUOLES AND THE RATE OF PULSATION OF THE CONTRACTILE VACUOLES IN *PARAMECIUM MULTIMICRONUCLEATUM*. John A. Frisch, Johns Hopkins University. (Introduced by S. O. Mast.)

The observations were made on individuals sealed in vaseline enclosures under cover glasses. The rate of pulsation of the posterior contractile vacuole and the rate of formation of the food vacuoles in given individuals were fairly constant. In different individuals the rate of pulsation of the posterior contractile vacuole varied from 10 to 30 seconds: the rate of formation of the food vacuoles varied from 21 to 64 seconds. These variations were directly related. There were from 2 to 3.5 pulsations of the contractile vacuole for every food vacuole formed, and this was independent of the time required for the formation of the food vacuole. This correlation is close enough to warrant the assumption that the main factor determining the rate of pulsation of the contractile vacuole is the rate at which water is taken in by the cytostome during feeding. This assumption is supported by the author's findings that when specimens are actively swimming and not feeding, the contractile vacuoles do not pulsate.

ECOLOGY

Read

154. STUDIES ON THE LIFE CYCLE AND ON REVERSAL OF SYMMETRY IN A FRESH WATER SNAIL, *CAMPELOMA RUFUM*. Harley J. Van Cleave, University of Illinois. (Charts; 10 min.)

Campeloma rufum has been studied in the Salt Fork River, near Urbana, Illinois, over a period of 4 years. Quantitative samples taken at all seasons

of the year have been studied, rate of growth, conditions of the uterine young, and seasonal aspects of the reproductive cycle. No separate males have been found at any time. Parturition is most active in May and does not continue beyond September 1st. In shells taken from the stream reversal of symmetry was found in 1.03 per cent. Uterine young show 5.83 per cent of reversal of coiling. Few sinistrals even reach bearing age. The differential in incidence of sinistrality in uterine young and free individuals will be discussed.

155. THE FAUNA OF WEST VIRGINIA CAVES. Albert M. Reese, West Virginia University. (Lantern; 10 min.)

During the past 3 years a hasty survey has been made of the life of forty-four of the caves of West Virginia. This will give a working basis for a more intensive study of some of the more favorable caves. The mammalia are represented in these caves by the wood or cliff rat, *Nectoma*, and by four species of bats. The amphibia by six species of salamanders. The fish by three species. The arthropods by twelve species of insects; three arachnids; two crustacea; two myriapods. The mollusc by one gastropod. The annelids by one species of earthworm. No study has yet been made of the microscopic fauna.

The only blind animal so far found is a tiny beetle, *Pseudanophthalmus*. The most common animals found are the so-called cave 'crickets,' *Ceuthophilus* and *Hadenoeus*.

156. A STUDY OF SEDIMENTATION IN A GLACIAL LAKE. Ira T. Wilson, Heidelberg College. (Lantern; 10 min.)

A series of twenty-three borings across Winona lake down to the original bottom was made and plotted as a cross section. They show the lake basin to lie in an outwash gravel plain. The original bottom presents a very uneven contour as contrasted to the present one which is fairly regular. The depth of the sedimentary deposits in the deep water is about twice as great as those of the shore. Zones of little or no deposition between the shore deposits and those of the deep water are revealed as due to the larger particles of sediment being sorted and distributed by shore currents but settling readily when they get below the base level of wave action while the very finely abraded materials go into suspension and are widely distributed and when settling out make the greatest accretion to the bottom in the deepest water. Chemical analyses show that the composition of the deposits vary from nearly pure organic matter to 90 per cent carbonate or to pure sand. The deposits richest in carbonate occur near the bottom in shore deposits and near the surface in deep water deposits. Alternating strata of sand and marl together with indications of sub-surface terraces suggest the interpretation that the level of the lake has fluctuated widely in the past indicating broad climatic changes.

By title

157. A COMPARISON OF THE VALUES OBTAINED FOR DISSOLVED OXYGEN IN WATER, USING THE WINKLER TITRATION METHOD AND THE MANOMETRIC VAN SLYKE METHOD. Charles Brambel and R. P. Cowles, Johns Hopkins University.

The Winkler method for the determination of dissolved oxygen in natural waters has been used for many years and has been found sufficiently accurate for most purposes. However, it is known that in the presence of certain compounds it must be used with care and that it must be modified if good results are to be obtained.

In order to compare the Winkler results with those obtained by the manometric Van Slyke apparatus (a direct measurement apparatus in which the dissolved oxygen is removed by the subjection of the water to a partial vacuum) a series of tests by the two methods were run simultaneously on distilled water equilibrated with the atmosphere. The results showed an agreement with not more than 1 per cent difference. Similar tests on brackish water in the region of Solomons Island, Maryland, U. S. A., showed closely similar results. But, the water taken from a sphagnum swamp in Woods Hole, Massachusetts, showed large differences between the values obtained by the two methods. In some tests these differences amounted to 40 or 50 per cent.

While it is probably possible to reduce this percentage of difference by modifying the Winkler method, it is more convenient and more accurate to use the manometric Van Slyke method and this can be done in the field. Not only is the method more accurate, since it is a direct measurement method, but also a smaller sample may be used and the determination may be made more rapidly.

158. STUDIES OF THE VALUES FOR DISSOLVED GASES, IN DEPTH SAMPLES OF BRACKISH WATER, COLLECTED WITH A PUMP AND WITH A SPECIAL SAMPLING APPARATUS. R. P. Cowles and C. E. Brambel, Johns Hopkins University.

In order to select the best method of collecting samples of water, taken from considerable depths, for the purpose of analysis of dissolved gases, a comparison has been made between the values obtained for O_2 , CO_2 and N_2 , when the samples were pumped to the surface from a depth of 25 meters and when they were collected, at the same depth, over mercury in a special apparatus made of glass.

The samples were taken from brackish water in the region of Solomons Island, Maryland, U. S. A., and the manometric Van Slyke apparatus was used for the determination of the amount of the gases.

A bronze, gear pump and a hose 1 inch in diameter, both made leak proof at all joints, were used for the pump samples and the latter were run under oil in glass-stoppered bottles. The mercury glass apparatus was firmly attached along side of the intake end of the hose and was lowered with the latter. It was so designed that it could be opened and closed by a cord extending from the apparatus to the surface of the water. Such an apparatus if properly handled must collect an unaltered sample, which may be transferred to the Van Slyke apparatus for analysis without loss of gas. In other words, the method may be considered as a standard for comparison with the pump method.

The values obtained by the two methods of collection show such close agreement that for the purposes of physiological work they may be considered as identical.

159. THE ACIDITY OF THE WATER OF A SPHAGNUM SWAMP. R. P. Cowles and Charles Brambel, Johns Hopkins University.

A study of such waters in Woods Hole, Massachusetts, U. S. A., shows that the degree of acidity is not stable, since the waters contain a large amount of carbonic acid much of which escapes quickly as CO_2 when a sample is removed to the laboratory.

Tests by titration for acidity combined with tests for total CO_2 with the manometric Van Slyke apparatus show that about two-thirds of the acidity is due to carbonic acid and about one-third to non-volatile acids. Since tests for organic acids were found to be positive and those for mineral acids negative, it is held that the non-volatile acids are organic. These acids were found to be thermostable.

Before the removal of the CO_2 by boiling or by treatment in the manometric Van Slyke apparatus, the pH averaged 4.20 but after such treatment it averaged 4.60 with no drift. This indicates a buffered condition in the water.

When the water was concentrated to a small bulk, so that it was dark brown in color and opalescent, and was then dialyzed, the colored liquid did not pass through. This result, together with the usual tests for colloids on untreated water, indicates a colloidal condition.

Tests for ferrous iron were negative so that the acidity was not due to this source.

160. THE INFLUENCE OF TEMPERATURE AND OTHER FACTORS ON THE WINTER AGGREGATIONS OF THE SUNFISH *LEPOMIS AURITUS*. C. M. Breder, Jr., New York Aquarium and R. F. Nigrelli, New York University.

On a reduction of temperature to 5°C . or below, *Lepomis auritus* (Linnaeus) aggregates into compact quiescent schools only if there is also present a slight current or an abnormally high concentration of CO_2 . This occurs only in the presence of light, as the school-forming reactions are apparently entirely visual. These schools appear to be entirely mechanical assemblages and refer to seeking a position of minimum effort, which is not in perfectly still water because of the forward thrust of the exhalant respiratory currents. The formation of schools in response to high CO_2 seems referable to the tendency for many animals to aggregate under adverse conditions.

Another species *L. incisor* (Cuvier and Valenciennes) does not aggregate under such conditions but remains in a disperse state, apparently seeking water of a slighter flow, which operates to make them seek approach to tank walls, et cetera, rather than each other in midstream.

It is inferred on the basis of the above and other considerations that schooling may be considered as a primary impulse, with cases of non-schooling as inhibitions of it caused by feeding, reproduction and other specific requirements. Any cessation of such influences causes an immediate reappearance of the schooling habit. This primary urge to aggregate, except as inhibited by definite influences, or secondarily released by adversity, may have general application.

MISCELLANEOUS

Read

161. AN INEXPENSIVE BALANCED DIET FOR TROUT AND SALMON. H. P. K. Agersborg, National Park Service. (15 min.)

A good trout food is an inexpensive substance easily procurable and perfectly suitable as human food which produces in trout rapid growth, vigorous health, splendid color, beautiful appearance, and a fish of palatable, desirable delicacy for human consumption. Such a food can be prepared from fresh sheep liver and heart, one part; young clupeidae, coddidae and mackerels and others including *Sarda sarda*, *Brevoortia tyrannus* and *Ammodytes americana*, one part; and salmon egg meal in equal part on the 50:50 solid bases. Young fish of diverse species constitute a balanced diet to young salmonids of any age, especially if the fish to be used as food are caught in a state of sexual ripeness or with their stomach filled with sexually ripe or egg-bearing crustacea and frozen while yet in rigor mortis, and kept in a solid frozen state until prepared for the meal. Old adult fish, especially a single given species, is not a balanced food for developing salmonids. Salmon egg meal, assorted young fish and sheep liver and heart in the proportion stated above produce such growth and vigorous health that this food cost is relatively only 1.6 cents per pound as compared with beef liver which costs 8 cents. Blue mussel, young mud crab and whole salmon egg, preserved in saline solution, may be substituted for any species of fish and if mixed well with the other ingredients the food cost may be reduced still further with added increase in the natural vigor and beauty of the fish reared and with supreme delicacy of taste.

162. MECHANISM AND SPECIFICITY OF SEXUAL REACTIONS OF *OSTREA VIRGINICA*. Paul S. Galtsoff, U. S. Bureau of Fisheries. (Lantern; 15 min.)

An ovulating female discharges its eggs into the cloaca from which they are sucked through the water tubes of the gills into the pallial cavity and ejected by the contraction of the adductor muscle. Sperm discharged into the cloaca by a spawning male is carried away in an ordinary manner by the outgoing current.

Ovulation takes place only at a temperature above 20° C. It can be stimulated by the sperm of the same or other species of the genus *Ostrea*, but not by sperm of other molluscs. Sexual reaction of the male is non-specific. It can be provoked by sperm of *Venus*, *Mya*, *Pecten*, *Mytilus*, and by the following hormones and organic compounds written in the order of their efficacy: thyroxin, extract of the anterior and posterior pituitary, corpus luteum, theelin, adrenalin, yeast, urea, glucose, galactose, arabinose, maltose, glutathione, peptone and egg albumen. The active principle of the sperm can be obtained from testes by extracting the tissues with 95 per cent ethyl alcohol and treating the extract with benzene and acetone.

By title

163. FURTHER OBSERVATIONS ON ADRENAL TUMOR IN THE FROG. W. M. Smallwood, Syracuse University.

Adrenal carcinoma in the frog was described in 1905. Additional specimens were not seen until 1933 when five specimens were discovered and four more this fall. We are attempting to produce experimentally these growths. I should be glad to receive specimens from various parts of the United States with records on the habitats of the diseased frog.

164. PIGMENTATION IN ITS RELATIONS WITH MELANOSIS IN CERTAIN TROPICAL FISHES. H. D. Reed and Myron Gordon, Cornell University.

Two types of black pigment cells have been found associated with melanosis in certain species of tropical fishes. These cells have been designated as micro- and macro-melanophores, respectively, the names being indicative of relative size. To determine which type of cell (or both) is more intimately associated with melanosis breeding experiments were undertaken. The results are: 1) When small cells only are present in the parents the hybrids are normal; 2) when both macro- and micro-melanophores are present in the parents in any combination or when macro-melanophores only are present the hybrid offspring becomes melanotic. Thus there is provided a reliable index to the differences in metabolism which result in normal or melanotic individuals.

According to the information thus far gained the so-called macro-melanophores cannot be regarded a type of pigment cell but rather pigmented cells.

The melanotic hybrids mentioned above were produced by crosses of *Platy-pocilus maculatus* and *Xiphophorus hellerii*.

165. QUALITATIVE AND QUANTITATIVE ANALYSES OF FOODS FOR SALMONIDS REARED ARTIFICIALLY. H. P. K. Agersborg, National Park Service.

Analysis of the various parts of fish reveals that the refuse has higher food values than the dressed fish. The pigmented epithelium, the skin, glands of head and viscera and the nervous system, the nervous system and viscera provide nutriments which with the skeleton constitute valuable foods. There is 43.3 per cent more water in beef liver than in dressed haddock and haddock wastes. Canned herring and Balto cannot be used as food for salmonids separately or in combination indefinitely without deficiency disease setting in. Salmon egg meal with either one of these does not remedy this; neither does adult whole silver hake. But assorted young fish, fresh non-diseased beef liver, sheep liver and heart with or without salmon egg meal will. Year-old salmonids in an artificial pool die when fed on canned herring longer than 2 weeks; 5500 brook trout and 2160 rainbow, of same species and age as in artificial pool, placed in a screened natural brook with overhanging vegetation and with a large number of black flies, gnats, mosquitoes and other insects constantly dropping into the stream and with a bottom composed of living diatomaceous earth full of shrimps, were fed on canned herring from May 31 to August 15, 1933, during which time they grew from 4 to 5½ inches to 10 to 14 inches. The amount of canned herring fed to the trout in the brook was only one-half as much as that fed to their fellows at the hatchery. It is waste of time and money to feed alfalfa, linseed meal, cottonseed meal and such like to trout.

166. WHEN DO THE RAINBOW TROUT SPAWN? H. P. K. Agersborg, National Park Service.

In its native waters of the McCloud River of California, *Salmo irideus* spawns during February, March, April. Outside its natural range the spawning time differs from this: At Wytheville, Virginia, November into February; in Colorado, early May until July; Neosho, Missouri, November 1st to March 1st; Manchester, Iowa, November 15th to March 15th; in Montana, April 15th to June 1st; Pittsford, Vermont, November to December, and April to June; and at Warren, New Hampshire, November into June. *Salmo irideus* and *S. shasta* from Klamath River, California and eggs from the steelhead trout, *S. gairdneri*, from Oregon and Washington, have been shipped east. Descendants from these have been distributed in public waters under the name of rainbow and have been included in brood stock at the various federal, state and commercial hatcheries. Hybridization among these named species is evidenced by the extensive variation in color, shape, number and size of black spots characterizing individuals, and in the marked differentiated prolongation of the spawning period beyond that in their native waters. In New Hampshire, stripping of the 'rainbow' has always been done in April. All *S. shasta* and *S. irideus* resembling rainbow which spawned prior to April, and the steelhead-like which spawn late (May to June) have never been stripped. Still from the April spawners, also rainbow-like in appearance, varieties have been produced, over a number of years, which spawn all the while from the last week in November to the middle of June. Evidently it would be better to segregate such hybrids and get the eggs from all the 'boarders.'

167. AQUACULTURE AND AGRICULTURE. H. P. K. Agersborg, National Park Service.

The idea advanced by some people that experimental studies in fish culture is too costly for a state like New Hampshire was completely refuted by the results which the injection of a little science into pisciculture produced in New Hampshire during 1932-1933, when for the first time in the history of the state the state fish hatcheries were temporarily placed on a scientific operative basis. During this time the water was measured, analyzed chemically, the pH values observed in relation to the temperature and hardness of the water, and salmonids were reared from the egg to $7\frac{1}{2}$ inches during the first 10 months of their life. The food was changed from beef liver of questionable quality to a diet resembling probably the natural optimum of salmonids. Five times more fish twice as large as in previous years were reared at less than two-thirds the cost of the previous season, with a saving to the state of 109,000.00. Legal sized fish were stocked not by township but in streams and ponds previously studied and determined suitable for salmonids. The result in revenue was unusual. Towns produced in 1 month (April 15 to May 15, 1934) more revenue from sale of fishing licenses than the same communities had produced during the whole period of 10 years previous. Just as in agriculture, science when applied to aquaculture can make a success of it also. The economic loss suffered by the public due to improper methods in fish culture, and the neglect of game, and fur bearing animals practiced by the several states is unbelievable.

168. COMPARATIVE RESISTANCE OF FIVE BREEDS OF CHICKENS TO THE NEMATODE *ASCARIDIA LINEATA* (SCHNEIDER). J. E. Ackert, L. L. Eisenbrandt, J. H. Wilmoth, B. Glading, and I. Pratt, Kansas State College.

Different degrees of resistance between breeds of one species to the same helminth have been established. The data supporting the conclusions were derived from experiments on 1351 chickens of five breeds (including two varieties) given the same numbers of eggs from the nematode *Ascaridia lineata* (Schneider). The criteria for judging the resistance were the average numbers and lengths of the *A. lineata* from each group of chickens under comparison. More resistant to the parasite were the heavy breeds, Rhode Island Reds and Plymouth Rocks, both White and Barred Plymouth Rocks. The more susceptible were the White Leghorns, Buff Orpingtons and White Minorcas. Two groups of White Minorcas differing in genetic constitution only by different sires exhibited marked differences in resistance. The heavy group proved to be more resistant to the *A. lineata* than the lighter group of the following year. Factors in the differences in resistance between the breeds and varieties appeared to include utilization of nervous energy by the most susceptible breed, possible genetic differences and normality and abnormality of host breeds.

169. PRELIMINARY REPORT ON THE PATHOLOGY OF AN INHERITED EYE DEFECT IN THE GUINEA PIG. J. H. Whitlock, Iowa State College. (Introduced by J. E. Ackert.)

A preliminary study was made of the pathology of an inherited eye defect which had appeared in the guinea pig colony maintained in the genetics laboratory. Previous workers have determined that the condition is probably due to a single mendelian recessive gene, although there is evidence that there may be one or more modifying factors. Animals are affected with the condition in varying degrees of intensity. However, the usual symptoms are a dullness and drying of the cornea, photophobia, some loss of tactile sense and thickening of the eyelids which may or may not be accompanied by a small amount of purulent exudate. Ulceration and keratinization have also been observed.

Microscopically the condition is a vascularization of the cornea accompanied by variable amounts of melanosis and varying inflammatory changes in the propria and epithelium of the cornea. It is believed that the condition is not due primarily to an inflammatory agent; first, because of the tendency of the infected eyes to show a little or no change in extent or severity of lesions from birth to death; second, because of the genetic behavior of the condition; third, because the amount of vascularization is never commensurate with other evidences of past or present inflammation; and fourth, because inflammation will not account for the melanosis of the cornea.

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NEW BOOKS AND PUBLICATIONS

NOTICES BY F. E. WELLS

FRANKLIN PAINE MALL, *The Story of a Mind*, by Florence Rena Sabin. 1934. Size, $5\frac{1}{4} \times 8\frac{1}{4}$ inches. Pages xiii + 342. Illustrated with 8 photographs. Index. Appendix. Bibliography. Cloth. Price, \$2.75. The Johns Hopkins Press, Baltimore.

For the writing of this book Doctor Sabin was well prepared by her long association with Doctor Mall as student and member of his staff and her own eminence in the field of biology. These factors enable her to know the personality of the man and to understand and evaluate his influence on the transformation of medical training and biological research in the United States. In this book we see the development of his remarkable mind, from his school-boy days in rural Iowa, through his medical training at the University of Michigan, and post-graduate studies in Germany where he formed lifelong friendships with such scholars as Ludwig and His, to his glorious career as investigator, teacher and counselor. His activities were varied and extensive. He wrote 104 published articles. He established a school of anatomy in this country and trained many who carried his type of anatomy to other laboratories. He founded an institute for embryology. He established journals and organized scientific societies. It was he who instigated the plan for full-time clinical teaching by which opportunities for research were made available to the clinics. It is fortunate that the new generation of students who benefit by the results of Doctor Mall's work should have this book which tells them something about the man and his place in American medicine.

INTRODUCTION TO PHYSIOLOGICAL PSYCHOLOGY, by Graydon LaVerne Freeman. 1934. Size, $5\frac{1}{4} \times 8\frac{1}{4}$ inches. Pages xvii + 579. 184 illustrations. Index. List of references following each chapter. Cloth. Price, \$4.50. The Ronald Press Company, New York.

Physiological psychology is defined by the author as the relationship between integrated behavior and the bodily processes of the intact organism. It covers those investigations and interests lying between psychology, physiology and neurology, which are not paramount to any one of them, and it emphasizes the essential unity of these sciences. The study of structure-functional relationships is its major problem. The material used in this book includes all significant developments in this field for the last 20 years, and is organized into four parts. Part I, on basic neural mechanisms in behavior, discusses the origin, development and relations of neural mechanism, and describes neurones, receptors, effectors and adjustors. Part II, the structure-functional organization of neural mechanisms, is concerned primarily with the part played in the behavior flux by

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different divisions of the nervous system. Part III, the integrative action of neural mechanisms, gives a picture of the mechanisms working together in a unitary manner. Part IV is on neural mechanisms and variable behavior. This last part deals with such complex subjects as motivation, neuromuscular sets and postures, learning, decrement, fatigue and oscillation, intelligence, and temperament. The book is useful either as a textbook in physiological psychology or as a reference work to students of medicine, education, sociology and zoölogy.

KREBS IM LICHTE BIOLOGISCHER UND VERGLEICHEND ANATOMISCHER FORSCHUNG, I Band, Ectodermkrebs, by Jos. Lartschneider. 1934. Size, $5\frac{1}{2} \times 8$ inches. 192 pages. Index. Bibliography. 48 illustrations. Price, RM 10. Franz Deuticke, Leipzig and Vienna.

This volume, the first of a series on cancer, is devoted to pathological growths in tissues derived from the ectoderm. It gives a comparative study of animal integument, and a brief review of theories of epithelium and cancerous growths. It describes and illustrates various diseases, including horn and skin cancer, mal perforant du pied, hoof cancer of horses, and others. The second volume which is now in preparation will treat of cancers arising from glandular and entodermal tissue.

NEW BOOKS AND PUBLICATIONS

NOTICES BY F. E. WELLS

A TEXTBOOK OF HISTOLOGY, by Alexander A. Maximow and William Bloom. Second edition. 1934. Size, 7×10 inches. pages xiv + 662. 530 illustrations, some of which are in colors. Index. Bibliographies. Cloth. Price, \$7.00. W. B. Saunders Company, Philadelphia and London.

Many improvements have been made in the second edition of this textbook. Recent findings in histology and histo-physiology have been incorporated into the text, and new illustrations have been added. It has been revised and rewritten to give improved balance between sections on basic tissues and those on organs. The chapters on the nervous system have a new arrangement. The entire study is now based on human material. Important facts and concepts are printed in large type, less significant matter is printed in smaller type, and the book is somewhat more compact and convenient to handle. The introductory chapter outlines methods used in histological study—observation of living cells, vital staining, supravital staining, and study of dead cells. The introduction also contains a description of the cell and its membrane, nucleous, organoids, and other components; and its activities which include respiration, assimilation of food, excretion and secretion, phagocytosis, movement and cell division. The primary tissues are considered in the chapters on general histology, after which the combination of tissues in different manners to form the various organs of the body are discussed in the chapters on special histology. Each chapter is followed by a complete and up-to-date bibliography.

OSTÉOLOGIE II. Crâne—Face, by A. Hovelacque. 1934. Size $7\frac{1}{2} \times 10$ inches. 294 pages. 127 illustrations, some of which are in color. Index. Price, 65 francs. Gaston Doin et Cie, Paris.

Volume II of this series deals with the bones of the head. It describes each bone from all angles and in relation to other bones. The illustrations are very well drawn and show attachments of the more important muscles as well as the shape and structure of the bones. The first part of the volume is devoted to the skull proper, the second part to the bones of the face.

PRATIQUE ANATOMO-CHIRURGICALE ILLUSTRÉE. ABDOMEN. Fascicule I, Région Abdomino-thoracique, by F. Paitre, H. Lacaze and S. Dupret. 1934. Size 7×10 inches. 406 pages. 747 illustrations. Price, 110 francs. Gaston Doin et Cie, Paris.

Stressing the connection between anatomy and surgery this book is planned and constructed for both the practicing surgeon and the student. The authors have followed a middle course in their treatment of the subject which is not too detailed for the anatomical student nor too general for the professional man. It avoids equally the tendency of pure anatomy to describe minutely each separate element however small, and the tendency of surgery to subordinate details to the dominant idea. This, the first section of the series, concerns itself with the thoraco-abdominal region and its organs—the stomach, the spleen, the liver and the hepatic peduncle, the pancreas and the duodenum, and the coeliac region.

NEW BOOKS AND PUBLICATIONS

NOTICES BY F. E. WELLS

A TEXTBOOK OF HISTOLOGY (new sixth edition), by Harvey Ernest Jordan. 1934. Size, $6\frac{1}{4} \times 10$ inches. Pages xxvii + 738. 609 illustrations. Index. Cloth. Price, \$7.50. D. Appleton-Century Company, Inc., New York.

As in former editions of this book the approach to histology is from the viewpoint of function, since it is believed that this method most successfully arouses the interest of the student. The present revision includes important new findings from many sources. In order to keep the book from being inconveniently large, certain parts of the old text have been condensed or eliminated. The most extensive additions and revisions are in the sections dealing with blood, the reticulo-endothelial system, the endocrine tissues, striped muscle, neuroglia, nervous tissue, the reproduction systems and the lymphoid organs. Illustrations are better and more numerous than before. Besides discussions of the cell, tissues, systems and organs, the volume contains a chapter on histological technique which describes preparatory steps required for microscopic examination of tissues, such as fixation, embedding, staining and mounting. There is also a section of forty-six pages devoted to directions for laboratory exercises.

THE AUTONOMIC NERVOUS SYSTEM, by Albert Kuntz. Second edition, enlarged and thoroughly revised. 1934. Size, $6 \times 9\frac{1}{4}$ inches. 697 pages. Illustrated with 73 engravings. Index. Extensive bibliography. Cloth. Price, \$7.50. Lea and Feabiger, Philadelphia.

That portion of the nervous system which regulates function in the viscera has been variously designated as involuntary, sympathetic, ganglionic, vegetative and autonomic. The author of this book prefers 'autonomic' and follows in general the classification and terminology of Langley. In bringing the edition up to date he has considered and evaluated results of many investigations into all phases of the subject. He has presented them in a form well planned to give the student a clear conception of the regulatory control of visceral function as exercised through the autonomic nerves, the importance of such control under normal physiological conditions, the interaction between the autonomic and cerebrospinal divisions of the nervous system, and the results of autonomic imbalance or other functional disturbance of the autonomic nervous system. The outline of contents is as follows: Introduction; Morphology and Distribution of the Autonomic Nervous System; The Autonomic Ganglion Cells; Central Autonomic Centers and Conduction Pathways; General Physiology of the Autonomic Nervous System; Development of the Autonomic Nervous System; Innervation of the Heart, of the Blood vessels, of the Respiratory System, of the Digestive Tract, of the Biliary System, of Glands, of the Urinary Organs, of the Sex Organs; Involuntary Innervation of the Eye; Autonomic Innervation of Skeletal Muscle; Pathology of the Autonomic Nervous System; Visceral Sensitivity and Referred Pain; Autonomic Imbalance; The Autonomic Nervous System in Disease; Surgery of the Autonomic Nervous System; Bibliography.

